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CONSENT ORDER AND AGREEMENT
BETWEEN
COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
AND
ARCO CHEMICAL COMPANY
BEAZER EAST, INC.

OCTOBER 20, 1997

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DEPARTMENT OF ENVIRONMENTAL PROTECTION**

AND

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BEAZER EAST, INC.**

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COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

IN THE MATTER OF:

ARCO CHEMICAL COMPANY	:	Clean Streams Law
BEAZER EAST, INC.	:	Solid Waste Management Act
Beaver Valley Plant	:	Land Recycling and Environmental
Potter Township	:	Remediation Standards Act
Beaver County	:	

CONSENT ORDER AND AGREEMENT

This Consent Order and Agreement ("CO&A") is entered into this 20th day of October, 1997, by and between the Commonwealth of Pennsylvania, Department of Environmental Protection ("Department"), ARCO Chemical Company ("ACC") and Beazer East, Inc. ("Beazer"). The Department, ACC and Beazer are collectively referred to as the "Parties."

The Department has found and determined the following:

The Parties and the History of the Beaver Valley Plant

A. The Department is the agency with the duty and authority to administer and enforce the Solid Waste Management Act, Act of July 7, 1980, P.L. 380, as amended, 35 P.S. §§ 6018.101-6018.1002 ("SWMA"); the Clean Streams Law, Act of June 22, 1937, P.L. 1987, as amended, 35 P.S. §§ 691.1-691.1001 ("Clean Streams Law"); the Air Pollution Control Act of January 8, 1960, P.L. 2119, as amended, 35 P.S. §§4001-4015 ("Air Act"), the Storage Tank and Spill Prevention Act, Act of July 6, 1989, P.L. 169, as amended, 35 P.S. §§6021.101-2104 ("Storage Tank Act"); the Land Recycling and Environmental Remediation Standards Act, Act of May 19, 1995, P.L. 2, 35 P.S. §§ 6026.101 et seq., ("Act 2"); Section 1917-A of the Administrative Code of 1929, Act of April 9, 1929, P.L. 177, as amended, 71 P.S. § 510-17

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("Administrative Code"); and the rules and regulations of the Environmental Quality Board ("rules and regulations") promulgated thereunder.

B. ACC is a Delaware corporation registered to do business in Pennsylvania since 1965. The address of ACC's corporate offices is 3801 West Chester Pike, Newtown Square, Pennsylvania 19073-3280.

C. Beazer, formerly known as Koppers Company, Inc., is a Delaware corporation registered to do business in Pennsylvania and with a place of business at One Oxford Centre, Suite 3000, Pittsburgh, Pennsylvania 15219.

D. ACC owned and operated a manufacturing facility known as the Beaver Valley Plant (the "Plant") at 400 Frankfurt Road, Monaca, Pennsylvania 15061. ACC or its predecessors became the owner of the real property on which the Plant is located in 1965. Beazer, then known as Koppers Company, Inc., owned and operated the Plant from 1946 to 1965.

E. On September 30, 1996, ACC sold the assets of the Plant to NOVA Chemicals Inc. ("NCI"). At the time of the sale, ACC manufactured polystyrene products and specialty foams. A description of the processes and operations at the Plant as of September 30, 1996, is set forth in Appendix A.

F. As part of the sale to NCI, ACC obtained subdivision approval from Potter Township to divide the Plant into two parcels in order to segregate the active operational area of the Plant from other areas. A map of the Plant as subdivided showing the areas that were characterized by ACC and Beazer is attached as Appendix B. ACC has leased to NCI the

operational area of the Plant as shown on Appendix B and intends to transfer title and ownership of that parcel to NCI in the future.

G. ACC and NCI have entered into agreements which allow ACC and others, including Beazer, to gain access to the operational area of the Plant now leased to and subsequently to be purchased by NCI to enable ACC and Beazer, among other things, to comply with the requirements of this CO&A. In addition, ACC granted to NCI certain access rights to the parcel that will be retained by ACC. These legal rights of access will appear in official records formally recorded with the deeds for the parcels when the operational area parcel is transferred from ACC to NCI. In addition, ACC and NCI have entered into agreements that provide for ACC's use of certain facilities and equipment at the Plant that will facilitate and simplify the implementation of the remediation activities agreed to by ACC and Beazer under this CO&A.

The 1994 Consent Order and Agreement

H. ACC and the Department entered into a Consent Order and Agreement on July 12, 1994, ("1994 CO&A") to continue site investigation and other work at the Plant based on the Department's determination that eight areas (subsequently reduced to six areas when certain areas were combined) required assessment and potential remediation. The 1994 CO&A also addressed certain regulatory matters regarding ongoing operations of the Plant. A copy of the 1994 CO&A is attached as Appendix C. Findings E (as modified by the Findings herein), F through I, K and L of the 1994 CO&A describing historical operations at the Plant and identifying the areas for remediation are incorporated herein by reference.

I. The Department has determined that ACC fully complied with the requirements of the 1994 CO&A by performing the following work:

1. Completing the assessment activities and submitting all plans and reports required by the approved Work Plan Overview and Paragraphs 3 and 4 of the 1994 CO&A.
2. Complying with the groundwater monitoring requirements and submitting groundwater monitoring reports to the Department as required by Paragraphs 5 and 6 of the 1994 CO&A.
3. Submitting all necessary permit applications and obtaining from the Department all necessary permits and approvals for the continued operation of the surface impoundments in use as part of the Plant's wastewater treatment system in satisfaction of Paragraph 8 of the 1994 CO&A.
4. Making all payments required by Paragraphs 9 and 10 of the 1994 CO&A.
5. Providing a copy of the 1994 CO&A to NCI and notifying the Department of ACC's intention to transfer an interest in the Plant as required by Paragraph 19 of the 1994 CO&A.

J. When the Department and ACC entered into the 1994 CO&A, they intended to negotiate a subsequent Consent Order and Agreement or Agreements for further investigatory work at those Areas of the Plant not covered by the requirements of the 1994 CO&A and for the remediation of the Plant.

Enactment of Act 2

K. Act 2 became effective on July 18, 1995, and sets forth both the substantive and procedural requirements necessary for the remediation of contaminated groundwater and

contaminated soils at the Plant in order to fully satisfy the legal obligations of ACC and Beazer under applicable Pennsylvania law.

L. Among the provisions of Act 2 applicable to the remediation of contaminated groundwater and contaminated soils to be performed by ACC and Beazer at the Plant pursuant to this CO&A are the following:

1. ACC and Beazer may select one or a combination of the three remediation standards (Background, Statewide Health or Site-Specific) for the remediation of contaminated groundwater and contaminated soils at the Plant taking into account the Plant's current and anticipated future use as a nonresidential site.

2. As part of the Site-Specific Standard under Section 304 of Act 2, an approvable cleanup plan for a site may include institutional controls, engineering controls and pathway elimination in addition to other remediation methods.

3. For purposes of determining compliance with the Statewide Health Standard or the Site Specific Standard for groundwater, the point of compliance is the property boundary or, if approved by the Department, a point beyond the property boundary. The lease and subsequent sale of the operational portion of the Plant to NCI does not change the point of compliance under Act 2. Nevertheless, ACC and Beazer, at their discretion, may establish monitoring points internal to the Plant to demonstrate attainment of the Act 2 groundwater standard at the point of compliance as defined under Act 2.

4. Pursuant to Section 902(a) of Act 2, ACC and Beazer are not required to obtain state or local permits or permit revisions other than as specified in Section 904(a) of Act 2 in order to perform Act 2 remediation activities at the Plant. In addition, the Department has

the authority to waive otherwise applicable state and local regulatory requirements based on the criteria established in Section 902(b) of Act 2.

5. When compliance with any one or a combination of the three remediation standards set forth in Act 2 is attained and the Department approves a final report, ACC and Beazer shall be entitled to cleanup liability protection under Section 501(a)(1) of Act 2, and NCI shall be entitled to cleanup liability protection under Section 501(a)(2) of Act 2.

Compliance with Act 2 Procedures

Site Characterization

M. Based on the work completed under the 1994 CO&A, ACC and Beazer have characterized contamination present at the Central Plant/Styrene II Area, Over-the-Hill Tank Farm Area, West Landfill/Dravo Quarry Area, Raccoon Creek Area, East Landfill Area and Phthalic Anhydride Area in accordance with the Act 2 regulations ("Site Characterizations"). Documentation of the Site Characterizations was submitted to the Department for each of these areas. A list of these submissions appears in Appendix C-1. These Site Characterizations meet the requirements for a site characterization required in a final report under the background standard and statewide health standard of Act 2 pursuant to Sections 302(b)(2) and 303(e)(2), and the remedial investigation required under the site specific standard of Act 2 under Section 304(l)(1).

N. On September 4, 1997, pursuant to the requirements of Act 2, ACC and Beazer filed a Notice of Intent to Remediate ("NIR") with the Department indicating their intention to remediate the Plant to one or a combination of the three remediation standards of Act 2. Notice of the NIR was given to Potter Township on September 4, 1997, and was published in the local

newspaper of general circulation on September 10, 1997. Potter Township has not requested the development of a public involvement plan.

O. On October 13, 1997, ACC and Beazer designated the Site Characterizations as the remedial investigation reports for the Plant under Act 2. The Department approves the remedial investigation reports.

Risk Assessment/Cleanup Plan

P. Based upon a presentation to the Department by ACC and Beazer of the results of preliminary risk assessments and the Department's review of the overview of the proposed remediation actions described in Appendix D, the Department has determined that the proposed remedies set forth in Appendix D meet the Act 2 site specific standard cleanup plan requirements of Section 304, including the remedy evaluation requirements of Section 304(j) set forth in and approved as part of Appendix D, contingent upon the Department's final review of risk assessments required by Section 304(l)(2) of Act 2 as part of the demonstration of the cleanup standards of Sections 304(b) and 304(c) of Act 2 ("Cleanup Plans"). Appendix D also sets forth the remedy for the Phthalic Anhydride Area which is intended to achieve the statewide health standard of Section 303 of Act 2. In addition, the Department has reviewed Appendix D with regard to permitting, operational and performance requirements and determined that the requirements specified in Appendix E are the relevant and applicable standards for the Act 2 cleanups to be undertaken by ACC and Beazer at the Plant.

Q. The Department asserts that the unauthorized disposal of chemicals and other materials at the Plant constitutes a violation of Sections 401 and 501 of the SWMA, 35 P.S.

§§ 6018.401 and 6018.501, and a public nuisance and unlawful conduct pursuant to Sections 601 and 610 of the SWMA, 35 P.S. §§ 6018.601 and 6018.610.

R. The Department asserts that the unauthorized disposal of chemicals and other materials that entered the ground water beneath the Plant constitutes a violation of Sections 301, 307 and 401 of the Clean Streams Law, 35 P.S. §§ 691.301, 691.307 and 691.401, and a public nuisance and unlawful conduct pursuant to Sections 3, 401 and 611 of the Clean Streams Law, 35 P.S. §§ 691.3, 691.401 and 691.611.

ORDER

After full and complete negotiations of all matters set forth in this CO&A, and upon mutual exchange of covenants contained herein, the parties desiring to avoid litigation and intending to be legally bound, it is hereby ORDERED by the Department and AGREED to by ACC and Beazer as follows:

1. Authority. This CO&A is an Order of the Department authorized and issued pursuant to Section 104(7) and 602 of the SWMA, 35 P.S. §§ 6018.104(7) and 6018.602; Sections 5, 316, 402, 501 and 610 of the Clean Streams Law, 35 P.S. § 691.5, 691.316, 691.402, 691.501 and 691.610; and Section 1917-A of the Administrative Code, 71 P.S. § 510-17.

2. Findings.

a. ACC and Beazer agree that the findings in Paragraphs A through P are true and correct and, in any matter or proceeding involving ACC, Beazer and the Department, ACC and Beazer shall not challenge the accuracy or validity of these findings. The Department asserts and ACC and Beazer deny the assertions in Paragraphs Q and R.

b. The Parties do not authorize any other persons to use the findings in this CO&A in any matter or proceeding. With respect to any such matter or proceeding, ACC and Beazer deny the findings in Paragraphs A through R and reserve the right to contest them.

3. Termination of ACC's Obligations Under the 1994 CO&A. As of the date of this CO&A, ACC has satisfied all of the requirements of the 1994 CO&A. Entry of this CO&A terminates ACC's obligations under the 1994 CO&A.

4. Remediation Plan Overview. The Parties have determined that the remediation activities at the Plant conducted pursuant to this CO&A will be performed in accordance with the remediation plan overview set forth in Appendix D, attached hereto and made a part hereof. In addition, the Parties have evaluated the environmental regulatory requirements that may be applicable to the remediation of the Plant and have included in Appendix E, attached hereto and made a part hereof, an agreement on the application of such regulatory requirements to ACC's and Beazer's remediation activities under this CO&A reflecting the exercise of the Department's authority under existing regulatory programs and Section 902 of Act 2.

5. Schedule of Submissions. To facilitate the Department's prompt review and approval of the plans and reports including, as appropriate, a pathway elimination report, a risk assessment, a cleanup plan and an implementation schedule for each area of the Plant, ACC and Beazer shall submit such plans and reports in final form for each of the six areas of the Plant for purposes of Act 2 review no later than June 30, 1998.

6. Final Reports Required for Liability Protection. ACC and Beazer shall submit to the Department for review and approval final reports and, where necessary and appropriate,

post remediation care program(s) when ACC and Beazer determine that the applicable remediation standards have been achieved.

7. Option to Submit Plans and Reports In Draft Form. ACC and Beazer may submit any of the above plans and reports, or portions of such plans and reports, in draft form for preliminary review by the Department prior to submitting such plans and reports in final form for Department approval. Within a reasonable time thereafter, the Parties shall discuss the plan or report submitted in draft form.

8. Department Approval of Plans and Reports. The Department shall approve or disapprove a final plan or report submitted in final form by ACC and Beazer. Upon approval of any final plan or report, the plan or report shall be incorporated in this CO&A as if fully set forth herein. Subject to Paragraph 28 (Termination) of this CO&A, all activities described in the approved plans or reports that must be performed by ACC and Beazer shall become further obligations of this CO&A. The process for review of the plans and reports submitted in final form by ACC and Beazer is set forth in Paragraph 11 hereof.

9. Modification of Approved Cleanup Plans. ACC and Beazer shall implement each cleanup plan according to the approved schedule. If ACC and Beazer desire to substantially modify an approved cleanup plan or schedule, prior to implementing any modification, ACC and Beazer shall notify the Department of any proposed modification and obtain the Department's approval for the modification. ACC and Beazer shall also document any modification by submitting it to the Department as a written amendment to the approved cleanup plan. The proposed modifications shall be subject to the process for review and approval and the dispute resolution procedures set forth in Paragraph 12 of this CO&A.

10. Cleanup Liability Protection. Upon demonstrating attainment of any one or a combination of the three cleanup standards under Act 2 in a final report for a remediation area and obtaining the Department's approval of such final report, ACC and Beazer shall be afforded the cleanup liability protection provided in Chapter 5 of Act 2 for each of the remediation areas for which a final report has been approved. For purposes of this CO&A, the site specific remedies set forth in Appendix D have been approved by the Department as acceptable cleanup plans under Act 2, subject to the Department's review and approval of risk assessment reports. In addition, Appendix D sets forth the Act 2 attainment demonstration requirements approved by the Department for the approved site specific remedies.

11. Process for Review of Plans and Reports. The following process shall be used for the review of plans or reports submitted by ACC and Beazer to the Department for final approval.

a. The Department shall approve or disapprove the plans and reports submitted by ACC and Beazer in final form within the time periods specified in Act 2. In addition, the Department shall use its best efforts to provide ACC and Beazer, within forty-five (45) days after receipt of such final plans and reports, written notice of the Department's preliminary determination whether such plan or report will be approved.

b. In the event the Department informs ACC and Beazer that the plan or report is deficient and will not be approved, ACC and Beazer, at their sole election, may take any one of the following actions:

(1) withdraw the plan or report so that the time period for the Department's review as specified by Act 2 does not expire;

(2) modify the plan or report to address the Department's comments so that the plan or report can be approved within the time period specified by Act 2;

(3) agree to extend the time period specified in Act 2 for the Department's review to enable the parties to resolve any disagreements; or

(4) notify the Department that no modifications will be made and request that the Department take final action on the plan or report as submitted.

c. In the event ACC and Beazer elect either to withdraw the plan or report as provided in subparagraph b(1), above, or to agree to extend the Act 2 time period as provided in subparagraph b(3), above, the Parties agree to follow the dispute resolution procedure described in Paragraph 12 of this CO&A.

d. Any final disapproval by the Department of a final plan or report submitted in final form by ACC and Beazer, shall be considered as final agency action for purposes of review by the Environmental Hearing Board ("EHB") pursuant to Section 308 of Act 2 and the procedures of paragraphs 12(e) and 12(f) shall apply except for the development of a Joint Dispute Statement. In the event that ACC and Beazer do not appeal the Department's final action on the plan or report within thirty (30) days of the date of the final action, then ACC and Beazer shall resubmit the plan or report incorporating the changes or correcting the deficiencies specified by the Department in its final action. ACC and Beazer shall resubmit the revised plan or report within sixty (60) days of the Department's final action on the plan or report.

12. Dispute Resolution.

a. To initiate dispute resolution, ACC and Beazer shall provide written notice to the Department within ten (10) working days of their election under Paragraph 11.b(1) or

11.b(3). ACC and Beazer shall have an additional ten (10) working days to provide the Department with a written list of objections to the Department's preliminary determination under Paragraph 11 or the Department's determination under Appendix D, Section IV (the "Statement of Position").

b. The Department shall have twenty (20) days following receipt of ACC's and Beazer's Statement of Position to provide its Response to ACC and Beazer.

c. Within the twenty (20) day period following receipt of the Department's Response by ACC and Beazer, the Department's Regional Director and ACC's and Beazer's representative shall meet and confer in an attempt to resolve the dispute. In the event the parties are unable to resolve the dispute in this fashion within this period, the Parties shall jointly set out in writing their unresolved differences, identifying the issues which remain in dispute and any work that ACC and Beazer can reasonably undertake that is unaffected by the issues that are in dispute (the "Joint Dispute Statement").

d. Following the Parties' development of the Joint Dispute Statement, the Department shall issue a written decision setting forth its final position on the issues in dispute. The Department's written decision shall constitute a final appealable action for purposes of review by the EHB.

e. During the pendency of an appeal by ACC or Beazer before the EHB of the Department's written decision, and until the later of such time as either (i) ACC and Beazer withdraw the appeal, or (ii) the parties reach agreement on the terms of the contested plan or report either through settlement negotiations or by means of an EHB opinion or adjudication and any appeals thereof, ACC and Beazer shall not be obligated to perform any

work set forth in the plan or report that is being contested except as set forth in the Joint Dispute Statement. In any appeal, ACC and Beazer shall not contest the foregoing Findings, or ACC's and Beazer's obligation to submit a plan or report.

f. In an appeal before the EHB, the parties shall have sixty (60) days to conduct expedited discovery. The period of discovery shall commence seven (7) days after ACC's and Beazer's Notice of Appeal is received by the Southwestern Region, Office of Chief Counsel. ACC and Beazer shall file its Pre-Hearing Memorandum within fifteen (15) days after the close of discovery. The Department shall file its Pre-Hearing Memorandum within fifteen (15) days of its receipt of ACC's and Beazer's Pre-Hearing Memorandum. Nothing contained herein shall preclude the parties from extending the foregoing schedule by mutual agreement.

g. Within thirty (30) days of a final resolution of the appeal, either through an EHB opinion or adjudication or through settlement negotiations that may occur during the pendency of the appeal before the EHB, ACC and Beazer shall modify the plan or report and schedule so that the plan or report and schedule conforms with the EHB opinion or adjudication or any settlement agreement reached between the parties (the "Modified Plan or Report"), and submit the Modified Plan or Report and schedule to the Department for its review and approval. Following agreement between the parties that the Modified Plan or Report conforms with the EHB opinion or adjudication or any settlement agreement between the Parties, the Modified Plan or Report shall be approved by the Department and incorporated into this CO&A as a further obligation of this CO&A. Nothing contained herein shall prevent ACC and Beazer or the Department from appealing a final decision of the EHB.

13. Penalties.

a. Stipulated Civil Penalties - Subject to the effects of Paragraph 12 (Dispute Resolution) and Paragraph 22 (Force Majeure), in the event ACC and Beazer fail to comply in a timely manner with any term or provision of this CO&A, ACC and Beazer shall be in violation of this CO&A and, in addition to other applicable remedies shall pay a stipulated civil penalty as follows:

(1) For failure to submit a plan or report pursuant to Paragraph 5 (Schedule of Submissions), ACC and Beazer shall pay stipulated penalties in the following amounts for each day the delay continues.

<u>Period of Delay</u>	<u>Amount/Day</u>
1st through 10th day	\$ 500.00
11th through 20th day	\$ 750.00
21st day and beyond	\$1,000.00

(2) For failure to pay Oversight Costs and Expenses pursuant to Paragraph 14 (Oversight Costs and Expenses) hereof, ACC and Beazer shall pay stipulated penalties in the amount of \$500.00 per day.

(3) For failure to comply with any approved plan or report, including modifications and schedules set forth in the approved plans and reports, ACC and Beazer shall pay stipulated penalties in the following amounts for each day the delay continues:

<u>Period of Delay</u>	<u>Amount/Day</u>
1st through 10th day	\$ 500.00
11th through 20th day	\$ 750.00
21st day and beyond	\$1,000.00

(4) ACC and Beazer shall pay stipulated penalties within thirty (30) days of receipt of written notice from the Department (the "written notice"). The Department is not obligated to assess a stipulated penalty pursuant to this CO&A. Prior to sending ACC and Beazer a written notice, the Department will send ACC and Beazer a letter advising ACC and Beazer of any failure to comply in a timely manner with any term or provision of this CO&A. This letter shall provide ACC and Beazer with a five (5) day period of time for curing its alleged failure to comply (the "five day cure period"). For the period prior to and during the five day cure period, ACC and Beazer shall not be subject to any stipulated penalties. Stipulated penalty payments shall be made by corporate check or the like made payable to "Commonwealth of Pennsylvania, Solid Waste Abatement Fund" and sent to Regional Director, Field Operations, 400 Waterfront Drive, Pittsburgh, Pennsylvania 15222-4745. It is understood by the parties hereto that payment of any money hereunder shall neither constitute a waiver of ACC's and Beazer's duty to meet its obligations under this CO&A nor preclude the Department from commencing an action to compel ACC's and Beazer's compliance with the terms and conditions of this CO&A, or any applicable statute, rule, regulation, permit or order of the Department. In no event will a stipulated penalty for failure to comply in a timely manner with any term or provision of this CO&A exceed the sum calculated pursuant to subsections 1, 2 and 3 of this Paragraph for thirty (30) days of violations.

(5) In the event that ACC and Beazer exercise their rights to appeal the Department's disapproval of any plan or report pursuant to Paragraph 12 (Dispute Resolution) of this CO&A, no civil penalty shall accrue during the pendency of such appeal. However, stipulated penalties shall accrue for failure to undertake work identified in the Joint Dispute Statement. Said penalty shall be payable in full within fourteen (14) days of receiving the Department's written notice of the amount of the penalty following the conclusion of ACC's and Beazer's appeal either (1) by a dispositive opinion or adjudication issued by the EHB in favor of the Department, or (2) by ACC's and Beazer's unilateral withdrawal of the appeal. In the event that the EHB opinion or adjudication rules partially in favor of the appellant and the respondent, the civil penalty shall be prorated to the extent the EHB rules in favor of the Department. In the event of an EHB order remanding matters to the Department and in the event ACC and Beazer disagree with the manner in which the Department acts pursuant to the remand order, the parties shall follow the dispute resolution procedures as described in Paragraph 12. In the event the parties are unsuccessful in resolving differences related to the action taken by the Department pursuant to the remand order, ACC and Beazer retain their rights to appeal said action in accordance with applicable procedures set forth in Paragraph 12. Civil penalties shall accrue during the pendency of said appeal and shall be payable within fourteen (14) days following the conclusion of said appeal as outlined above in this paragraph.

b. Civil Penalties - To fully satisfy the requirements of Paragraph 9 of the 1994 CO&A, ACC shall pay an annual civil penalty of Ten Thousand Five Hundred Dollars (\$10,500) for each of the six areas to be addressed under this CO&A for which plans and reports required under Paragraph 5 of this CO&A are not received by the Department by December 31,

1997. The amount due for each area shall be prorated based on the number of months that have elapsed beyond December 31, 1997, before the plans and reports for that area are submitted to the Department. The civil penalty required under this provision, if any, shall be payable to the Department within sixty (60) days of the date that the plans and reports for the last of the six areas is submitted to the Department. Payments shall be made by corporate check or the like and forwarded to the address specified in subparagraph 13.a.(4), hereof.

14. Oversight Costs and Expenses.

a. ACC shall reimburse the Department for its reasonable costs and expenses incurred in the review of any plan or report submitted to the Department either in draft or final form and for any other work performed by the Department in overseeing ACC's and Beazer's performance of any work described in the approved plans and reports submitted pursuant to this CO&A.

b. The Department shall use its best efforts to submit to ACC and Beazer by August 1, 1998, and every twelve (12) months thereafter, a detailed accounting of oversight costs and expenses incurred by the Department relating to the above-described activities. The accounting shall include (i) identification of Department personnel involved with the above-described activities; (ii) the number of hours devoted to the activities performed by such individual; (iii) a general description of the activities by such individual; and (iv) the hourly base salary and benefits costs for such individual's time. The Department will be reimbursed for its overtime personnel costs, including overhead, and travel costs. The Department will also be reimbursed for all of its expenditures to third parties for work directly related to activities

identified above, and costs for analyses of samples performed for the Department either in its own laboratory or in a contract laboratory.

c. Within sixty (60) days of the date of an accounting by the Department, ACC shall forward a check to the Department at the address specified in subparagraph 13.a.(4), hereof, and made payable according to the fund identified and the specifications included in the accounting for all costs not disputed by ACC. In addition, ACC shall identify any disputed items which ACC shall not be obligated to pay until they have a reasonable opportunity to meet with the Department to discuss the items in dispute. The parties shall use their best efforts to resolve any dispute regarding oversight costs.

d. Payment of oversight costs by ACC shall not be construed or interpreted as an endorsement or approval by ACC of the activities or conclusions of the Department or the Department's consultants. Moreover, because ACC has agreed to pay the Department's oversight costs, the fees associated with the submission of plans and reports under Act 2 are subsumed within the oversight costs.

15. Additional Remedies.

a. In the event ACC and Beazer fail to comply with any provision of this CO&A, the Department may, in addition to the remedies prescribed herein, pursue any remedy available for a violation of an order of the Department, including an action to enforce this CO&A.

b. The remedies provided by this Paragraph and Paragraph 13 (Penalties) are cumulative and the exercise of one does not preclude the exercise of any other. The failure of the Department to pursue any remedy shall not be deemed to be a waiver of that remedy. The

payment of a stipulated civil penalty, however, shall preclude any further assessment of civil penalties for the violation for which the stipulated civil penalty is paid.

c. The Department will not pursue any remedy, other than a stipulated civil penalty, for a violation of Paragraph 5 (Schedule of Submissions) or Paragraph 14 (Oversight Costs and Expenses) if the violation is corrected within thirty (30) days.

16. Reservation of Rights. Except for contamination identified in the Site Characterizations and other documentation submitted pursuant to Act 2 for the areas identified in Appendix B, the Department reserves its right to require additional measures to achieve compliance with applicable law. ACC and Beazer reserve their rights to defend, contest or challenge any action which the Department may take to require additional measures to achieve compliance with applicable law.

17. Liability of ACC and Beazer. ACC and Beazer shall be liable for any violations of the CO&A, including those caused by, contributed to, or allowed by its officers, agents, employees, or contractors.

18. Transfer of Site.

a. The Department acknowledges that the operational area of the Plant currently leased to NCI will be transferred to NCI. Notwithstanding such a transfer and except as provided in Paragraph 18.c., the duties and obligations of ACC and Beazer under this CO&A shall not be modified, diminished, terminated or otherwise altered by the transfer of any legal or equitable interest in the Plant or any part thereof.

b. If ACC transfers any legal or equitable interest in the Plant which is affected by this CO&A, ACC shall serve a copy of this CO&A upon the prospective transferee

of the legal and equitable interest at least thirty (30) days prior to the contemplated transfer and shall simultaneously inform the Regional Director, Southwest Regional Office of the Department of such intent.

c. Upon request by ACC and Beazer, the Department in its sole discretion may agree to modify or terminate ACC's and Beazer's duties and obligations under this CO&A upon the transfer of all or a portion of the Plant. ACC and Beazer waive any right that it may have to challenge the Department's decision in this regard.

19. Correspondence with Department. All correspondence with the Department concerning this CO&A shall be addressed to:

Regional Environmental Cleanup Program Manager
Field Operations
Southwest Region
400 Waterfront Drive
Pittsburgh, PA 15222-4745

20. Correspondence with ACC. All correspondence with ACC concerning this CO&A shall be addressed to:

Thomas J. Walsh
Manager Cost Engineering, Planning
and Remediation Projects
ARCO Chemical Company
3801 West Chester Pike
Newtown Square, PA 19073

In addition, ACC agrees that service of any notice or any legal process for any purpose under this CO&A, including its enforcement, may be made by mailing a copy by first class mail to its

attorney at the following address:

V. Peter Wynne
Counsel
ARCO Chemical Company
3801 West Chester Pike
Newtown Square, PA 19073

21. Correspondence with Beazer. All correspondence with Beazer concerning this CO&A shall be addressed to:

James A. Cook
Project Manager
Beazer East, Inc.
One Oxford Centre
Suite 3000
Pittsburgh, PA 15219

In addition, Beazer agrees that service of any notice or any legal process for any purpose under this CO&A, including its enforcement, may be made by mailing a copy by first class mail to its attorney at the following address:

General Counsel and Secretary
Beazer East, Inc.
One Oxford Centre
Suite 3000
Pittsburgh, PA 15219

22. Force Majeure.

a. In the event that ACC and Beazer are prevented from complying in a timely manner with any time limit imposed in this CO&A solely because of a strike, fire, flood, act of God, or other circumstances beyond ACC's and Beazer's control and which ACC and Beazer, by the exercise of all reasonable diligence, are unable to prevent, then ACC and Beazer may petition the Department for an extension of time. An increase in the cost of performing

the obligations set forth in this CO&A shall not constitute circumstances beyond ACC's and Beazer's control. ACC's and Beazer's economic inability to comply with any of the obligations of this CO&A shall not be grounds for any extension of time.

b. ACC and Beazer shall only be entitled to the benefits of this Paragraph if they notify the Department within ten (10) working days by telephone and within twenty (20) working days in writing of the date they become aware or reasonably should have become aware of the event impeding performance. The written submission shall include all necessary documentation, as well as a written statement made subject to penalty for falsification from an authorized individual specifying the reasons for the delay, the expected duration of the delay, and the efforts which have been made and are being made by ACC and Beazer to mitigate the effects of the event and to minimize the length of the delay. The initial written submission may be supplemented within ten (10) working days of its submission. ACC's and Beazer's failure to comply with the requirements of this Paragraph specifically and in a timely fashion shall render this Paragraph null and of no effect as to the particular incident involved.

c. The Department will decide whether to grant all or part of the extension requested on the basis of all documentation submitted by ACC and Beazer and other information available to the Department.

23. Severability. The paragraphs of this CO&A shall be severable and should any part thereof be declared invalid or unenforceable, the remainder shall continue in full force and effect between the parties.

24. Entire Agreement. This CO&A shall constitute the entire integrated agreement of the parties. No prior or contemporaneous communications or prior drafts shall be relevant

or admissible for purposes of determining the meaning or intent of any provisions herein in any litigation or any other proceeding.

25. Attorney Fees. The parties shall bear their respective attorney fees, expenses and other costs in the prosecution or defense of this matter or any related matters arising subsequent to the execution of this CO&A.

26. Modifications. No changes, additions, modifications or amendments of this CO&A shall be effective unless they are set out in writing and signed by the parties hereto.

27. Titles. A title used at the beginning of any paragraph of this CO&A may be used to aid in the construction of that paragraph, but shall not be treated as controlling.

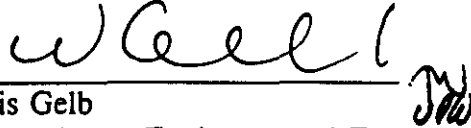
28. Termination.

a. The obligation of ACC and Beazer under this CO&A, including the payment of the Department's oversight costs, shall terminate upon the Department's approval of a final report pursuant to the requirements of this CO&A. Post remediation care programs, if any, included by ACC and Beazer as part of an approved final report shall not be enforceable as a condition of this CO&A.

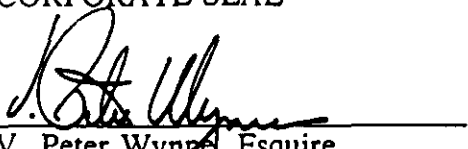
b. ACC and Beazer agree that they will not assert Section 505 of Act 2 as a defense in any action by the Department against ACC and Beazer for failure to perform post-remediation care required as part of a final report approved by the Department under this CO&A. This agreement by ACC and Beazer shall not apply to any action by the Department on any other grounds or to any action by any third party. This subsection of Paragraph 28 is for the sole benefit of the Department and shall survive termination of this CO&A.

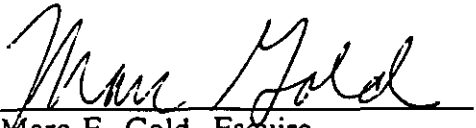
IN WITNESS WHEREOF, the parties hereto have caused this CO&A to be executed by their duly authorized representatives. The undersigned representatives of ACC and Beazer certify under penalty of law, as provided by 18 Pa. C.S. §4904, that they are authorized to execute this CO&A on behalf of ACC and Beazer; that ACC and Beazer consents to the entry of this CO&A as a final ORDER of the Department; and that ACC and Beazer hereby knowingly waive their rights to appeal this Consent Order and Agreement and to challenge its content or validity, which rights may be available under Section 4 of the Environmental Hearing Board Act, the Act of July 13, 1988, PL. 530, No. 1988-94, 35 P.S. §7514; the Administrative Agency Law, 2 Pa. C.S. §103(a) and Chapters 5A and 7A; or any other provisions of law. Signature by ACC's and Beazer's attorneys certifies only that the agreement has been signed after consulting with counsel.

FOR ARCO CHEMICAL COMPANY

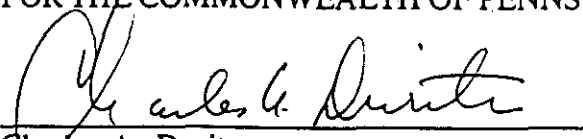

Morris Gelb
Vice President, Environmental Emergency
and Manufacturing Programs
ARCO Chemical Company


CORPORATE SEAL

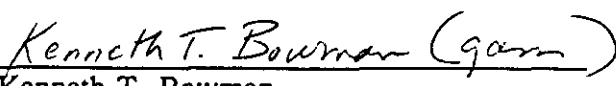

V. Peter Wynne, Esquire
Counsel for ARCO Chemical Company


Marc E. Gold, Esquire
Manko, Gold & Katcher


FOR THE COMMONWEALTH OF PENNSYLVANIA


Charles A. Duritsa
Regional Director
Field Operations
Southwest Region

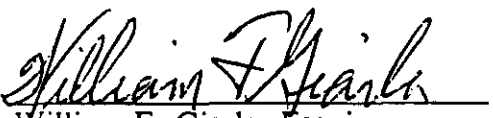

Gail A. Myers
Assistant Counsel



Kenneth T. Bowman
Assistant Counsel

FOR BEAZER EAST, INC.


James Brennan
Vice President
Beazer East, Inc.

CORPORATE SEAL


William F. Giarla, Esquire
Beazer East, Inc.


Joseph K. Reinhart, Esquire
Babst, Calland, Clements and Zomnir, P.C.

APPENDIX A
DESCRIPTION OF PLANT OPERATIONS AS OF SEPTEMBER 30, 1996

Plant manufacturing processes which were in operation as of September 30, 1996, include the production of polystyrene, expandable polystyrene specialty polymer products, specialty polymeric foams, and a styrene and maleic anhydride copolymer called Dylark.

Polystyrene is produced at Plant D3 by batch polymerization of styrene droplets suspended in water. Polymer impregnation with pentane to produce expandable polystyrene is also carried out batch-wise in water suspension at Plants D3 and D4. The D2 Plant produces a family of moldable specialty foams via batch processes. Specialty polymer products are made in the D4 Plant.

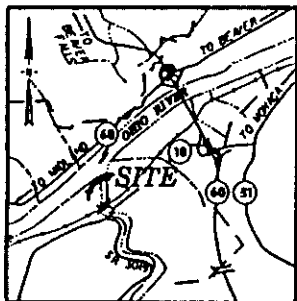
Styrene and maleic anhydride are polymerized to produce the copolymer product in the Dylark Plant.

The D2 Plant and the Dylark Plant are located in the CP/SII Area. The D3 and D4 Plants are located immediately to the west of the CP/SII Area and north of the West Landfill Area.

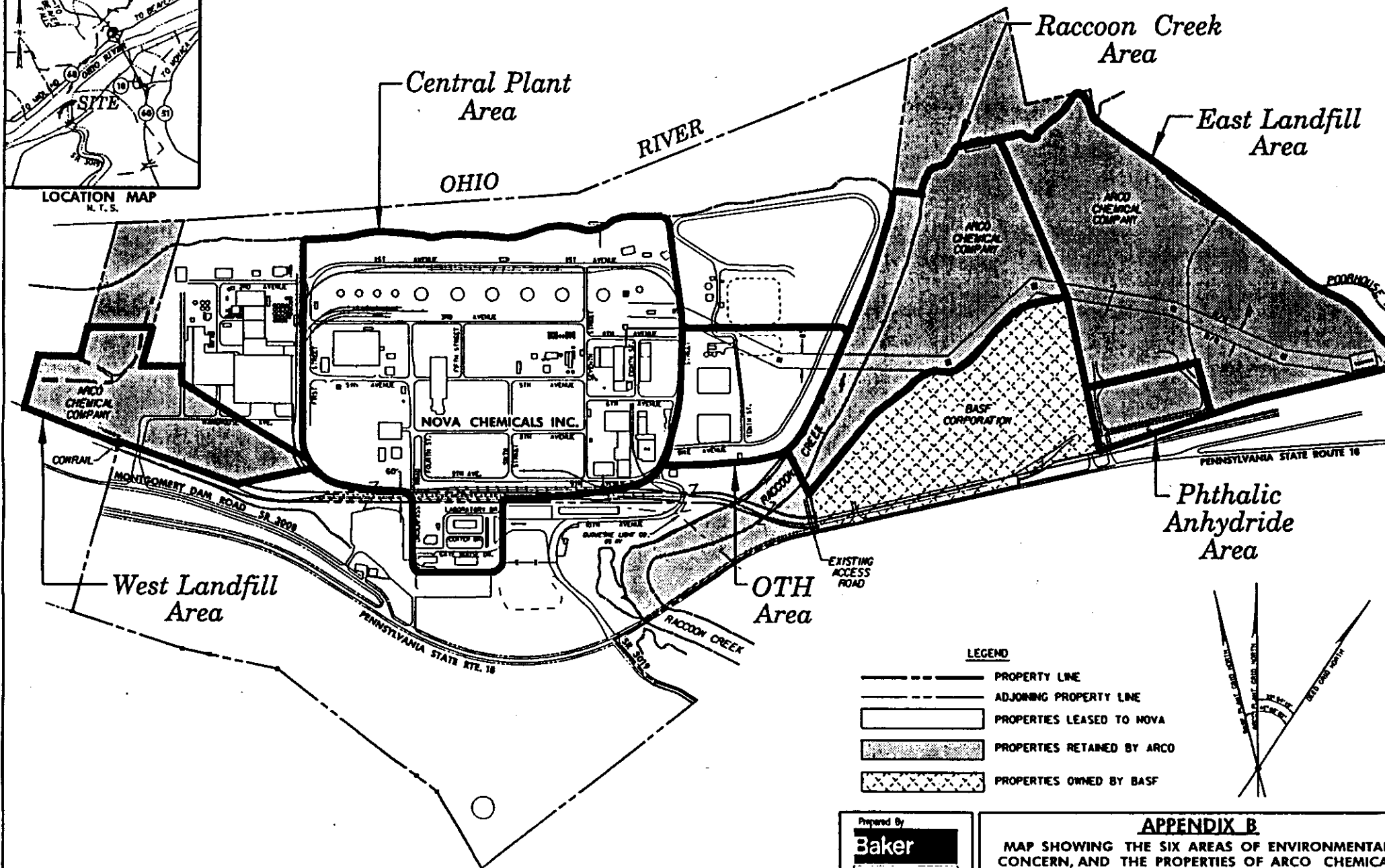
Utility systems in operation as of September 30, 1996 include:

- The river water pumping station located north of the Raccoon Creek Area;
- The process wastewater treatment plant and surface impoundments located immediately north and west of the Over-the-Hill Tank Farm Area;
- The coal storage yard located immediately north of the Over-the-Hill Tank Farm Area;
- The coal and oil fired boiler house with steam and electric generating facilities and fuel oil storage tanks. These aboveground facilities are owned by AES and are located in the CP/SII Area.

In addition to the operating units on the site, structures included an Administration building, a Central Lab building, a Development and Technical Services building, an EH&S building, a Fire Station, Maintenance buildings, Electrical substations and warehouse facilities.



LOCATION MAP
N.T.S.



800 0 800 1600
SCALE IN FEET

REVISED: 10/8/97

LEGEND

- PROPERTY LINE
- ADJOINING PROPERTY LINE
- PROPERTIES LEASED TO NOVA
- PROPERTIES RETAINED BY ARCO
- ▨ PROPERTIES OWNED BY BASF

Prepared By
Baker

Michael Baker 2, Inc.
Engineers and Surveyors
4301 Dutch Ridge Road
Beaver, Pa. 15009
412-485-7711

APPENDIX B

MAP SHOWING THE SIX AREAS OF ENVIRONMENTAL
CONCERN, AND THE PROPERTIES OF ARCO CHEMICAL
AND NOVA CHEMICALS INC.

LOCATED IN
POTTER TOWNSHIP, BEAVER COUNTY, PA.

SCALE: AS SHOWN

DATE: APRIL 7, 1997

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

IN THE MATTER OF:

ARCO Chemical Company	:	
Beaver Valley Plant	:	Clean Streams Law
Potter Township	:	Solid Waste Management Act
Beaver County	:	

CONSENT ORDER AND AGREEMENT

This Consent Order and Agreement ("CO&A") is entered into this
12th day of ~~June~~^{July}, 1994, by and between the Commonwealth of
Pennsylvania, Department of Environmental Resources ("Department"), and ARCO Chemical
Company ("ARCO").

FINDINGS

The Department has made the following findings. Paragraphs E through I, T and W are based on factual representations made by ARCO, to the best of its knowledge, and on the sampling data gathered by ARCO and the Department. With the exception of Paragraphs AA and BB of the findings, ARCO does not dispute the findings and ARCO agrees not to challenge them in any future proceeding with the Department. The Department asserts and ARCO denies the assertions in Paragraphs AA and BB, below. With respect to any action or proceeding by a third party, ARCO denies all of these findings and reserves the right to contest them.

A. The Department is the agency with the duty and authority to administer and enforce the Solid Waste Management Act, Act of July 7, 1980, P.L. 380, as amended, 35 P.S. §§6018.101-6018.1002 ("SWMA"); the Clean Streams Law, Act of June 22, 1937, P.L. 1987, as amended, 35 P.S. §§691.1-691.1001 ("Clean Streams Law"); Section 1917-A of the Administrative Code of 1929, Act of April 9, 1929, P.L. 177, as amended, 71 P.S. §510-17 ("Administrative Code"); and the rules and regulations of the Environmental Quality Board ("rules and regulations") promulgated thereunder.

B. ARCO Chemical Company is a Delaware corporation registered to do business in Pennsylvania since 1965. The address of ARCO's corporate offices is 3801 West Chester Pike, Newtown Square, Pennsylvania 19073-3280.

C. ARCO owns and operates a manufacturing facility known as the Beaver Valley Plant (the "Plant") the address of which is 400 Frankfort Road, Monaca, Pennsylvania 15061. ARCO or its predecessors has been the owner of the real property on which the Plant is located since 1965.

D. The Plant is located on the south bank of the Ohio River, in Potter Township, Beaver County, Pennsylvania, on approximately 420 acres (the "Site"). Other waters of the Commonwealth that flow through or bound the Site include Raccoon Creek and Poorhouse Run.

E. The initial manufacturing and support facilities at the Plant were constructed in the period 1942-43 by the Koppers United Company acting as agent for the United States Government under a lease agreement from the Defense Plant Corporation, and an operating agreement from the Rubber Reserve Company. The Plant was subsequently purchased in

two stages by the Koppers Company in 1946 and 1955, respectively. Koppers also operated the Plant for the United States Government and for itself between 1943 and 1964. In 1965, the Sinclair-Koppers Company purchased the Plant and operated it between 1965 and 1974. The Plant was then owned and operated by ARCO Polymers, Inc. (1974 to 1981), ARCO Chemical Company, a division of Atlantic Richfield Company (1981 to 1987), and ARCO Chemical Company (1987 to present).

F. The initial manufacturing facilities produced a group of organic chemicals which were used to make synthetic rubber. During the 1940's, the manufacturing facilities at the plant produced the following commercial grade organic chemical products: 1,3-butadiene, benzene, ethylene, ethylbenzene, and styrene monomer. The butadiene and styrene products were shipped to an off-site location where they were combined to make synthetic rubber.

(i) The butadiene product was produced from ethyl alcohol (grain alcohol) which was brought to the Plant. The styrene was produced by dehydrogenating ethylbenzene. The ethylbenzene was produced by the alkylation of benzene with ethylene. Benzene was produced through the acid treatment and distillation of "light oil", a by-product of coke ovens from nearby steel mills. The ethylene was produced through the dehydration of ethyl alcohol. The styrene monomer was produced through the integration of the benzene, ethylene, and ethylbenzene production facilities at the Plant. The benzene, ethylene and ethylbenzene production facilities, together with the styrene production facility, collectively functioned as an integrated facility for the production of styrene.

(ii) The integrated sequence of steps to make styrene monomer also produced several mixtures of organic chemicals which required further processing. These mixtures were processed in the benzene production facility using the distillation equipment which was available there. For example, the styrene manufacturing process generated a mixture of benzene and toluene ("B/T mix"). The B/T mix was further processed at the benzene production facility to recover benzene. After the benzene production facility was shut down, the B/T mix was shipped offsite for distillation to recover both benzene and toluene. The ethylbenzene manufacturing process also produced mixtures of higher molecular weight alkyl-benzenes (called "polyethylbenzene"). These mixtures were also sent to the benzene production facility to recover a diethylbenzene which was sold directly. The non-recoverable portion of the B/T mix and polyethylbenzene was burned in the Plant boilers as fuel.

G. The focus of manufacturing at the Plant changed during the period from the 1950's through the 1980's away from organic chemicals used to make synthetic rubber and toward the production of various types of polystyrene. The butadiene production facilities were shut down in 1953. The ethylbenzene facility was shut down in 1967. The benzene production facility ceased processing light oil as a source of benzene in 1967. It was used to recover benzene from B/T mix until it was shut down in 1977. The Styrene I production facility was shut down in 1977. The Styrene II production facility was shut down in 1991. These changes significantly reduced the need to handle substantial volumes of liquid organic chemicals and organic chemical mixtures at the Plant.

H. At various times during the operation of the Plant, certain chemicals, multi-component chemical mixtures, and other materials spilled, leaked or were deposited at the Site, some of which caused contamination of the soils at certain locations at the Site and the ground water underlying certain areas of the Site. The substances found in the soil and ground water at the Site include benzene, toluene, ethylbenzene, diethylbenzene, styrene, B/T mix, light oil (a mixture of benzene and numerous other aromatic compounds), "polyethylbenzene" (a mixture of alkyl-benzene isomers), organic chemical and polymer residues, fuel oil constituents, spent catalysts (such as iron, chromium and potassium oxide), phosphate sludges, and ash from the coal fired boilers located at the Plant.

I. ARCO has identified eight (8) different areas at the Site for the purpose of developing and implementing remedial actions to remove pollutants from the soils and the ground water. The location and approximate boundaries of these eight areas are shown on the map attached to this CO&A as Appendix "A". The areas are identified as the Central Plant Area, the Styrene II Area, the Over-the-Hill Tank Farm Area, the Raccoon Creek Area, the West Landfill Area, the Dravo Quarry Area, the East Landfill Area, and the Phthalic Anhydride Plant Area (collectively referred to as the "Areas"). Subsequently, the Central Plant and Styrene II Areas ("Central Plant/Styrene II Area") and the West Landfill and Dravo Quarry Areas ("West Landfill/Dravo Quarry Area") were combined into two units for purposes of future investigation. [Consolidation of these Areas changes the number of units for future investigation from eight (8) to six (6).] A description of the materials which have been found in each of the six (6) Areas and a description of activities occurring in certain of the Areas are set forth below:

(i) Central Plant/Styrene II Area (formerly the location of facilities which manufactured butadiene, benzene, ethylene, ethylbenzene and styrene, chemical storage facilities, an on-site power plant and fuel storage tanks serving the power plant):

Chemical constituents identified in both the subsurface soils and ground water include benzene, toluene, ethylbenzene, xylenes, styrene, light-oil components, alkyl benzene isomers including polyethylbenzene compounds, and fuel oil components. Benzene, toluene, and ethylbenzene are the principal constituents found in the ground water. The concentrations and relative amounts of these three components vary in ground-water samples collected from different locations. Analyses of soil samples and a non-aqueous phase liquid ("NAPL") found at some locations indicate the presence of benzene, toluene, ethylbenzene, xylenes, styrene, and polyethylbenzene isomers. Ethylbenzene and diethylbenzene isomers are the principal constituents of the organic contaminants found in the NAPL.

(ii) Over-the-Hill Tank Farm Area:

Eight aboveground storage tanks were previously utilized to store light oil, fuel oil, benzene, ethylbenzene, and B/T mix in this area. The original two tanks were installed in 1943. The remaining six tanks were installed in 1952. The tanks were decommissioned at various times beginning in 1962. All of the tanks were dismantled by 1988. Chemical constituents identified in both the subsurface soils and ground water include benzene, ethylbenzene, and alkyl-benzene isomers.

(iii) Raccoon Creek Area:

The Raccoon Creek Area was used from shortly after 1943 until 1975 for the disposal of various plant wastes. Acid washings (light oil treated with sulfuric acid)

and distillation residues from the benzene production facilities were burned in pits which were excavated for this purpose. Tars and polymeric residues from the butadiene facility were also burned in this area. Fly ash from the coal fired boilers was subsequently placed over the former disposal pits. Chemical constituents identified in subsurface soils include benzene, toluene, ethylbenzene, xylenes, and polynuclear aromatic compounds. Benzene and toluene are the principal constituents present in the ground water.

(iv) West Landfill/Dravo Quarry Area:

The West Landfill Area served as the primary disposal area for the Plant's process wastes from 1943, or shortly thereafter, until 1972. The primary waste streams disposed of include acid washings and light oil residues from the benzene facility, residue from the styrene facilities, waste polystyrene and expandable polystyrene beads, aqueous toluene solutions containing less than 1% toluene used to clean the internal surfaces of polymerization reactors, and spent catalysts. Chemical constituents identified in the subsurface soils and/or ground water in this area include benzene, toluene, ethylbenzene, xylenes, styrene, polychlorinated biphenyls (PCBs) and various semi-volatile organic compounds. Part of the Dravo Quarry portion of this area has been contaminated by the migration of substances from the West Landfill and by the occasional disposal of styrene tar from the styrene facility.

(v) East Landfill Area:

The East Landfill Area was used from time to time until 1986 for the disposal of calcium phosphate sludge generated during polystyrene production, waste polystyrene and expandable polystyrene beads, and aqueous toluene solutions containing less

than 1% toluene used to clean the internal surfaces of polymerization reactors. Chemical constituents identified in the ground water beneath the locations where materials were buried include benzene and toluene.

(vi) Phthalic Anhydride Plant Area:

A facility which produced phthalic anhydride from naphthalene was operated at this location between 1946 and 1962. Mercury was utilized as a heat transfer media. All aboveground structures and equipment were removed in 1970. Production waste materials were buried in this area and possibly in the adjacent East Landfill Area. Mercury is the principal constituent identified in soils of this area. Other constituents found in the soils include ethylbenzene, toluene, xylene and naphthalene.

J. ARCO has agreed to pay civil penalties as set forth in Paragraph 9 of this CO&A. ARCO has also agreed to make additional payments to the Ohio River Valley Sanitation Commission ("ORSANCO") and to the Ohio River Basin Consortium for Research and Education ("ORBCRE") as set forth in Paragraph 9 of this CO&A. The contribution to ORSANCO will be used to support operation of its Organics Detection System which presently consists of fourteen (14) detection stations at water intakes on the Ohio River and certain of its tributaries. One of the organic detection stations is located five (5) miles downstream of the Plant. The contribution to ORBCRE will be used to fund graduate level studies and/or research to determine the impact of ground-water contamination on the upper Ohio River.

K. The analyses of samples of soils, ground water, and NAPL collected from the Areas confirm the presence of multiple contaminants described as chemical constituents in Paragraph I of this CO&A.

L. Any waste generated, stored, treated or discharged from the extraction, removal or remediation of ground water and soils at the Site are solid wastes under the SWMA, and these wastes may be characteristic hazardous wastes pursuant to 25 Pa. Code Chapter 261, Subchapter C. The Department asserts, and ARCO denies, that these wastes are also industrial wastes under the Clean Streams Law. The Department has determined that such wastes will not be regulated as listed hazardous waste as defined in 25 Pa. Code Chapter 261, Subchapter D.

M. ARCO has submitted to the Department reports of remedial investigation/feasibility studies ("Reports") for the Raccoon Creek, Central Plant, Styrene II, and Over-the-Hill Tank Farm Areas. It was subsequent to the submittal of said Reports, that the Central Plant Area and the Styrene II Area were combined into one unit for purposes of investigation and future remediation.

N. The Reports for the Areas referenced in Paragraph M describe, among other things, characterization activities and development of remedial action plans. The Reports for the Central Plant, Styrene II and the Over-the-Hill Tank Farm Areas identify several remediation technologies for further study including, but not limited to, soil vapor extraction, ground-water pump and treat and in-situ bioremediation.

O. In May, 1992, ARCO submitted the Beaver Valley Plant Work Plan Overview for testing and remedial process design (the "Work Plan Overview") that, among other

things, proposed certain pre-remediation work activities to be performed at the Central Plant, Styrene II and Over-the-Hill Tank Farm Areas to refine existing data about these Areas, and to determine design criteria for a remediation system. The additional work activities are grouped according to the following six (6) categories of tasks ("Tasks 1 through 6"), each of which requires the submission of a written work plan (the "work plan or plans") followed by a report describing the results obtained through implementation of the work plan:

- | | |
|--------|---------------------------------|
| Task 1 | Planning and Mobilization |
| Task 2 | Supplementary Site Sampling |
| Task 3 | Hydrogeology Studies |
| Task 4 | Ground-water Treatability Tests |
| Task 5 | Soil Vapor Extraction |
| Task 6 | In-Situ Bioremediation |

P. By letter dated July 30, 1992, the Department advised ARCO of certain revisions to the Work Plan Overview and requested that ARCO incorporate said comments into the individual work plans and the Work Plan Overview. A copy of the Work Plan Overview for Tasks 1 through 6 is attached hereto as Appendix "B".

Q. Based on information currently available, the following is an overall preliminary schedule for the completion of Tasks 1 through 6 described in the Work Plan Overview for the Central Plant, Styrene II and Over-the-Hill Tank Farm Areas.

<u>TASK</u>	<u>OTII AREA Time Period</u>	<u>CP/SII AREA Time Period</u>
Task 1	Ongoing Throughout Tasks 2 - 6 At Both Areas	
Task 2	4th Quarter 1993	4th Quarter 1993
Task 3	1st Quarter 1994	1st Quarter 1994
Task 4	Ongoing Throughout Tasks 3 and 6 At Both Areas	
Task 5	3rd Quarter 1994	3rd Quarter 1995
Task 6	4th Quarter 1994	4th Quarter 1995

R. As of the date of this CO&A, the status of work on Tasks 1 through 6 is as follows:

(i) Work on Tasks 2 and 3 has been completed in both the Central Plant/Styrene II and Over-the-Hill Tank Farm Areas. Task 2 reports with the results from supplementary site sampling were submitted to the Department on December 15, 1993 (Over-the-Hill Tank Farm Area) and December 23, 1993 (Central Plant/Styrene II Area). Task 3 reports with the results from hydrogeological studies from each area were submitted to the Department on April 1, 1994 (Over-the-Hill Tank Farm) and April 8, 1994 (Central Plant/Styrene II Area). Each task was implemented in accordance with a work plan previously approved by the Department.

(ii) A Task 4 work plan describing the temporary treatment system for ground water produced by field tests in the Central Plant/Styrene II and Over-the-Hill Tank Farm Areas was submitted to the Department on September 17, 1993. The Department approved the use of this system in letters dated October 7 and 15, 1993. A Task 4 interim

report with the results from the treatment of ground water produced by the Task 3 hydrogeological studies was submitted to the Department in March 1994.

(iii) A work plan for Task 5 soil vapor extraction tests in the Over-the-Hill Tank Farm Area was submitted to the Department on September 10, 1993. The Department approved this work plan in letters dated October 6 and 7, 1993. On March 29, 1994, an interim technical report and work plan outline for further soil vapor extraction tests was submitted to the Department. This report contained the results from soil vapor extraction tests conducted in the Over-the-Hill Tank Farm Area during the 4th quarter of 1993, and outlined additional tests planned for 1994.

(iv) A work plan for the Task 6 in-situ bioremediation tests in the Over-the-Hill Tank Farm Area was submitted to the Department on February 4, 1994. The Department approved this work plan in a letter dated May 3, 1994. Laboratory bioremediation tests have been completed as part of Task 6, and final plans for field tests were reviewed with the Department at a meeting on May 4, 1994.

S. An issue incidental to the scope of this CO&A relates to ARCO's January 4, 1993 submission to the Department of information required by 25 Pa. Code §287.111 (Transition System for Existing Facilities). This submission constituted ARCO's request that three of the four surface impoundments currently in use primarily within the Over-the-Hill Tank Farm Area and which are part of the permitted industrial wastewater treatment facility (the "surface impoundments" and the "permitted wastewater treatment facility"), be considered eligible for permit by rule under 25 Pa. Code Section 287.102 (Permit by rule) of the residual waste regulations. These three surface impoundments are currently in active

operation and receive the Plant's process wastewater for storage and processing prior to its discharge into Outfall No. 002 (Raccoon Creek). They operate under authorization of Water Quality Management Permit No. 0471208 and National Pollution Discharge Elimination System Permit No. PA0006254. The fourth surface impoundment is currently inactive. The surface impoundments are shown on the map attached as Appendix "A".

T. The surface impoundments and Outfall 002 will not receive the effluent produced during the pre-remediation field tests; however, effluent produced during long-term remediation activities may flow into these surface impoundments depending on ARCO's decisions regarding their future disposition.

U. In a letter dated July 8, 1993, the Department indicated that it does not appear that the surface impoundments comply with certain requirements of 25 Pa. Code §287.102. In this letter the Department requested information from ARCO about its plans, if any, for installing a liner system in the surface impoundments and for a ground-water monitoring plan to determine the effect of the surface impoundments, if any, on ground water at the Plant.

V. On February 2, 1994, ARCO submitted for Department review and approval a proposed ground-water monitoring plan and implementation schedule for the surface impoundments. A more detailed schedule was provided with the first monitoring report which was submitted to the Department on March 23, 1994. By letter dated April 21, 1994, the Department approved the plan and schedule.

W. ARCO desires to integrate its current use of the surface impoundments with its future plans for handling the Plant's process wastewater and wastewater generated by the approved remediation system.

X. A second issue incidental to the scope of this CO&A relates to pumping of deep well No. 1, a well located within the Central Plant/Styrene II Area near the bank of the Ohio River. In 1980, ARCO began pumping ground water from deep well No. 1 in order to create a localized depression in ground-water elevations surrounding this well. The depression in ground-water elevation was used to collect a floating NAPL containing various contaminants, primarily ethylbenzene. This floating NAPL is believed to have created a hydrocarbon sheen on the Ohio River surface in the vicinity of the river bank where deep well No. 1 is located. Two additional wells were installed in 1980 near deep well No. 1 for the purpose of recovering the NAPL which accumulated in the ground-water table depression surrounding deep well no. 1. These two wells are called EB-1 and EB-2. An automated oil-skimming device was utilized at the EB-1 and EB-2 wells to recover NAPL.

ARCO measured, sampled and recovered the above-described NAPL from the EB-1 and EB-2 wells from June 1980 until 1992. In late 1992, ARCO requested Department approval to cease pumping deep well No. 1 based on ARCO's assertion that recovery of floating NAPL was no longer necessary. The Department agreed that ARCO could cease pumping deep well No. 1 provided ARCO continued monitoring and sampling six (6) well points in the vicinity of the well and along the edges of the Ohio River. On January 19, 1993, due to monitoring reports indicating the presence of increased levels of organics at two (2) of the monitoring points along the Ohio River, ARCO resumed pumping deep well No. 1. Several subsequent monthly monitoring reports indicated a decrease in the organics present in samples from the two (2) well points. On or about July 8, 1993, the Department agreed that ARCO could cease pumping deep well No. 1 provided ARCO, among other

things, installed additional monitoring well points along the property line adjacent to the Ohio River and continued monitoring the well points in the vicinity of this well on a monthly basis for a minimum of two (2) years. A letter dated August 5, 1993 from the Department to ARCO advises ARCO on this matter.

Y. On or about September 1, 1993, ARCO ceased pumping deep well No. 1. On or about September 13, 1993, ARCO installed additional monitoring well points. On or about March 28, 1994, ARCO agreed to install more monitoring well points constructed with sand packs at locations along the river selected by ARCO and the Department. All monitoring well points referenced in this paragraph shall be hereinafter collectively referred to as the "additional monitoring well points."

Z. A third issue incidental to the scope of this CO&A involves ARCO's request that the Department temporarily approve Outfall No. 001 (Ohio River) to receive treated ground water generated by the pre-remediation field tests required to be performed at the Central Plant/Styrene II Area and the Over-the-Hill Tank Farm Area. ARCO proposes to collect and treat the wastewater generated by these field tests in a temporary wastewater treatment facility (the "proposed temporary wastewater treatment facility"). This request raised the question whether the use of the proposed temporary wastewater treatment facility qualifies for hazardous waste permit by rule under the provisions of 25 Pa. Code §265.433. By letters dated October 7, 1993 and October 15, 1993, the Department advised ARCO of the hazardous waste permit by rule requirements applicable to the proposed temporary wastewater treatment facility. In addition, a letter dated April 11, 1994 from the Department to ARCO (the "April letter") sets forth the terms and conditions of the temporary wastewater

discharge authorization. A true and correct copy of the April letter is attached hereto as Appendix C. ARCO's compliance with the monthly average and daily maximum discharge limits set forth in the April letter does not constitute a waiver of its right to appeal any discharge limits specified in any NPDES permits issued by the Department to ARCO in the future..

AA. The Department asserts that the unauthorized disposal of chemicals and other materials at the Site constitutes a violation of Sections 401 and 501 of the SWMA, 35 P.S. §§6018.401 and 6018.501, and a public nuisance and unlawful conduct pursuant to Sections 601 and 610 of the SWMA, 35 P.S. §§6018.601 and 6018.610.

BB. The Department asserts that the unauthorized disposal of chemicals and other materials that entered the ground water beneath the Site constitutes a violation of Sections 301, 307 and 401 of the Clean Streams Law, 35 P.S. §§691.301, 691.307 and 691.401, and a public nuisance and unlawful conduct pursuant to Sections 3, 401 and 611 of the Clean Streams Law, 35 P.S. §§691.3, 691.401 and 691.611.

CC. The parties desire to resolve the foregoing matters without resorting to litigation. Further, it is the intention of the parties to negotiate a subsequent Consent Order and Agreement(s) for further investigatory work at those Areas of the Site not covered by the requirements of this CO&A and for remediation of the Site.

ORDER

After full and complete negotiations of all matters set forth in this CO&A, and upon mutual exchange of covenants contained herein, the parties intending to be legally bound, it is hereby ORDERED by the Department and AGREED to by ARCO as follows:

1. This CO&A is an Order of the Department authorized and issued pursuant to Sections 104(7) and 602 of the SWMA, 35 P.S. §§6018.104(7) and 6018.602; Sections 5, 316, 402, 501 and 610 of the Clean Streams Law, 35 P.S. §§691.5, 691.316, 691.402, 691.501 and 691.610; and Section 1917-A of the Administrative Code, 71 P.S. §510-17. The failure of ARCO to comply with any term or condition of this CO&A shall subject ARCO to all penalties and remedies provided by those statutes for failing to comply with an Order of the Department.

2. The Work Plan Overview for Tasks 1 through 6 at Central Plant/Styrene II and the Over-the-Hill Tank Farm Areas, attached as Appendix B hereof, shall be incorporated into this CO&A as further obligations of this CO&A.

3. The following process shall be utilized for the review and approval of the various work plans to be submitted for Tasks 1 through 6 and as such process may otherwise be referenced in this CO&A.

a. ARCO shall submit three (3) copies of each work plan for Department review and approval and include a suggested return date for the Department's review comments. A proposed implementation schedule shall be included as part of each work plan which will encompass all tasks and subtasks in the work plan including submission of any reports to the Department. All field/lab work to be performed in the course of a Task shall be described in detail in the work plan. All work plans shall clearly state the objectives of the proposed work, and how the objectives will be achieved.

b. If the Department approves the work plan, the work plan shall become an obligation of this CO&A. If the work plan is not approved in whole or in part, the

Department will notify ARCO in writing detailing its rationale for returning the work plan to ARCO and proposing modifications ("the written notification"). ARCO shall respond to the Department's written notification within thirty (30) days of its receipt unless the Department's written notification specifies a longer response time. The Department may approve a longer time period for a response from ARCO. ARCO shall respond by either accepting the Department's proposed modifications or rejecting one or more of said modifications and providing the Department with ARCO's detailed rationale for the rejection ("ARCO's response"). ARCO's response shall also include written compromise proposals, if any, relating to the rejected modifications for the Department to consider.

If ARCO accepts the Department's proposed modifications, ARCO shall resubmit the work plan revised to incorporate the proposed modifications. The Department will notify ARCO in writing of its approval of the revised work plan and the work plan shall be incorporated into this CO&A as further obligations of this CO&A.

c. If, following review of ARCO's response, either the Department or ARCO determines that a meeting would be useful to discuss any outstanding differences, the parties shall meet to define and attempt to resolve such differences regarding the work plan (the "meeting"). At the end of the meeting, if there remain unresolved differences, the parties shall jointly set out in writing said differences, identifying which of the Department's proposed modifications are in dispute and which tasks and/or subtasks of the work plan are affected by the disputed modifications ("the joint dispute statement"). The joint dispute statement will reflect only what the parties agree are the modifications of the work plan in dispute and the tasks and/or subtasks affected by the disputed modifications.

d. Following the meeting, if remaining differences exist, the Department shall issue a written final order, constituting an appealable action, with a copy of the joint dispute statement attached to the order. The order will direct ARCO to implement the work plan as modified by the Department. During the pendency of an appeal of the Department's final written order by ARCO before the Environmental Hearing Board ("EHB"), and until the later of such time as (i) ARCO withdraws the appeal, or (ii) the parties reach agreement on the terms of an amended work plan as described below in Paragraph 3.g, ARCO shall not be obligated to perform the tasks and/or subtasks of the work plan that are identified in the joint dispute statement.

e. In the event the Department and ARCO resolve outstanding differences regarding the work plan at the meeting, ARCO shall amend the work plan to incorporate any changes or additions agreed to by the parties at the meeting and submit the amended work plan to the Department for final approval. Thereafter, the approved work plan shall be incorporated into this CO&A as a further obligation thereof.

f. In the event ARCO appeals from the Department's final written order, ARCO shall have the burden of proof to demonstrate that the Department's modifications that are identified in the joint dispute statement were unreasonable based on a preponderance of the evidence. Moreover, ARCO shall have the right to contest and seek a stay with respect to any other provision of the final written order in accordance with the procedures and standards established under Pennsylvania law. In any appeal, ARCO shall not contest the foregoing findings, or ARCO's obligation to submit a work plan or perform all work plans finalized pursuant to the procedures set forth in this CO&A.

g. In any appeal, the parties shall have sixty (60) days to conduct expedited discovery. The period of discovery shall commence seven (7) days after ARCO's Notice of Appeal is received by the Southwestern Region, Office of Chief Counsel. ARCO shall file its Pre-Hearing Memorandum within fifteen (15) days after the close of discovery. The Department shall file its Pre-Hearing Memorandum within fifteen (15) days of its receipt of ARCO's Pre-Hearing Memorandum. Nothing contained herein shall preclude the parties from extending the foregoing schedule by mutual agreement. Within thirty (30) days of a final resolution of the disputed modifications, tasks and/or subtasks either through an EHB opinion or adjudication or through settlement negotiations that may occur during the pendency of the appeal before the EHB, ARCO shall prepare a new draft of the work plan amended in conformance with the EHB opinion or adjudication or any settlement agreement reached between the parties (the "amended work plan"), and submit the amended work plan to the Department for its review. Following agreement between the parties that the amended work plan conforms with the EHB opinion or adjudication or any settlement agreement between the parties, the amended work plan shall be incorporated into this CO&A as a further obligation thereof. Nothing contained herein shall preclude ARCO or the Department from appealing a final decision of the EHB.

4. a. ARCO shall implement the schedules for completing Tasks 1 through 6 as contained in the work plans for the Central Plant, Styrene II and Over-the-Hill Tank Farm Areas submitted pursuant to Paragraph 3.a. If ARCO desires to substantially modify an approved work plan, prior to implementing any modification, ARCO shall notify the Department of any proposed modification and obtain the Department's approval for the

modification. ARCO shall also document any approved modification by submitting it to the Department as a written amendment to the approved work plan. The proposed modifications shall be subject to the process for review and approval and the dispute resolution procedures set forth in Paragraph 3 of this CO&A.

b. All reports for Tasks 2 through 6 shall be submitted within sixty (60) days after completion of each task's work activities in the field and receipt of final laboratory data unless a time extension is requested and approved. All reports shall include a detailed narrative presenting the results, all data generated, the method or methods and/or rationale underlying data analysis and interpretation, including all limitations, assumptions, modeling files, calculations and formulas used.

5. ARCO shall continue monitoring the well points in the vicinity of deep well No. 1 and the additional monitoring well points (See Paragraph Y) on a monthly basis for a minimum period of two (2) years from the date of this CO&A. All monitoring data shall be submitted to the Department within sixty (60) days of sampling the points.

6. From time to time; and at a minimum frequency of every six (6) months from the date of this CO&A, the Department and ARCO shall discuss and evaluate monitoring data from all the monitoring well points.

7. By authorization of the April letter (see Finding Z), which is hereby incorporated into this CO&A to reflect the obligations described therein as further obligations under this CO&A on the part of ARCO, ARCO shall provide temporary treatment of pumped ground water generated by the pre-remediation field tests that will be performed at the Central Plant/Styrene II Area and the Over-the-Hill Tank Farm Area.

8. a. The ground-water monitoring plan and schedule for the surface impoundments referenced in Paragraph V hereof shall be deemed to satisfy 25 Pa. Code §299.144(a)(5), and shall be incorporated into this CO&A as further obligations of this CO&A.

b. ARCO may continue storage and processing of industrial wastewater in the surface impoundments at least until August 1, 1995, provided that by that date ARCO submits to the Department either a plan and schedule to bring the existing surface impoundments of the permitted wastewater treatment facility into compliance with the operating requirements of 25 Pa. Code Chapter 299 (Storage and Transportation of Residual Waste), or a plan and schedule to close and replace the surface impoundments. The proposed plan and schedule shall be subject to the process for review and approval and the dispute resolution procedures set forth in Paragraph 3 of this CO&A. The plan and schedule, established as a result of the process for review and approval and the dispute resolution procedures set forth in Paragraph 3 hereof, shall be incorporated into this CO&A as further obligations of this CO&A. ARCO may continue storage and processing of industrial wastewater in the surface impoundments pending Department review of the proposed plan and schedule and until such time as

(i) the proposed plan and schedule are approved by the Department or any disputed modifications of the proposed plan and schedule are resolved pursuant to procedures set forth in Paragraph 3 of this CO&A; and

(ii) ARCO has completed implementation of the approved plan and schedule.

In the event ARCO submits a proposed plan and schedule to bring the existing permitted wastewater treatment facility into compliance with the requirements of Chapter 299, upon Department certification of compliance with the requirements of Section 287.102, 25 Pa. Code §287.102, ARCO will be deemed to have a permit by rule for operation of the wastewater treatment facility in accordance with 25 Pa. Code §287.102(c). In reviewing the proposed plan and schedule the Department agrees to consider ARCO's wastewater treatment needs, any remediation ARCO has ongoing and future remediation plans.

9. Civil Penalties.

a. Within thirty (30) days of the date of this CO&A, ARCO shall pay a civil penalty of THREE HUNDRED THOUSAND DOLLARS (\$300,000.00) in settlement of those matters described in subsections (i) and (ii) below.

(i) Any operation of unpermitted solid waste management facilities, including but not limited to processing and disposal, at the Site; and

(ii) Any pollution or contamination of the soil, ground water or surface water at the Site which occurred as a result of Plant operations since 1942, including the Areas identified in Paragraph I hereof, as well as any other areas of the Site that may have been contaminated due to leaks, spills or disposal of waste which was generated as a result of chemicals used or manufactured on the Site premises.

b. The payment shall be made by corporate check or the like made payable to "Commonwealth of Pennsylvania, Solid Waste Management Fund" and sent to Charles A. Duritsa, Regional Director, Field Operations, Pennsylvania Department of Environmental Resources, 400 Waterfront Drive, Pittsburgh, Pennsylvania 15222-4745.

c. This civil penalty does not cover pollution or contamination resulting from chemicals which were not used, manufactured or generated at the Site. This penalty also does not cover any unauthorized disposal of waste by ARCO into the soil, ground water or surface water in or around the Site subsequent to the date of this CO&A except as provided in subsection d of this paragraph.

d. ARCO shall pay the following additional civil penalty covering continuing pollution or contamination resulting from any leaks, spills, or disposal activities described in subsections a.(i) and a.(ii) above, provided that such leaks, spills or disposal activities causing the continuing pollution or contamination occurred prior to the date of this CO&A. Until such time as ARCO has commenced active remediation for each of the six (6) areas of soil and ground-water contamination at the Site identified in Paragraph I hereof, ARCO shall pay an annual penalty for existing, ongoing and as yet unremediated Site contamination. The annual penalty shall be in the initial amount of Sixty Three Thousand Dollars (\$63,000.00), which amount shall be payable to the Department within sixty (60) days from the date of this CO&A. The payment shall be made by corporate check or the like made payable to "Commonwealth of Pennsylvania, Clean Water Fund," and forwarded as described in Paragraph 9.b. of this CO&A. The second annual penalty payment shall be made on January 15, 1995, and future installments of the annual penalty shall be made on January 15th of each succeeding year. Upon commencing active remediation of the Central Plant/Styrene II Area pursuant to an approved remediation plan, and likewise upon commencing active remediation of each additional Area, the amount of this annual penalty shall be reduced by Ten Thousand Five Hundred Dollars (\$10,500.00). Upon commencing

active remediation of the sixth Area of soil and/or ground-water contamination at the Site, all areas of the Site will be in active remediation and the annual penalty shall be reduced to zero. The term "to commence active remediation" shall mean the date, after the Department's approval of the Final Design/Work Plan, upon which ARCO either receives Department approval for the last of any permits that may be necessary to implement the approved remediation or executes all necessary contracts to implement the approved remediation, whichever is earlier.

e. ARCO agrees to contribute additional sums of money annually to the Ohio River Valley Sanitation Commission ("ORSANCO") and to the Ohio River Basin Consortium for Research and Education ("ORBCRE") until such time as ARCO has commenced active remediation for each of the six (6) Areas of soil and ground-water contamination at the Site. The annual contributions shall be made on the dates set forth in subsection 9.d. above, and shall be calculated as follows:

(i) for the contribution to ORSANCO, apply a multiplier of fifteen percent (15%) to the annual penalty described in subsection 9.d. above;

(ii) for the contribution to ORBCRE, apply a multiplier of five percent (5%) to the annual penalty described in subsection 9.d. above.

ARCO shall make such payments directly to the appropriate representatives of ORSANCO and ORBCRE as set forth below and shall provide the Department with a copy of the correspondence transmitting each payment. The contributions to ORSANCO shall be made by corporate check or the like made payable to the "Ohio River Valley Sanitation Commission" and sent to the following address:

Ohio River Valley Water Sanitation Commission
5735 Kellogg Avenue
Cincinnati, Ohio 45228-1112

The contributions to ORBCRE shall also be made by corporate check or the like made payable to the "Ohio River Basin Consortium for Research and Education Foundation" and sent to the following address:

Ohio River Basin Consortium for Research and Education
c/o Leo Weaver, P.E., Executive Director
6978 Presidio Court
Cincinnati, Ohio 45244

10. Oversight Costs and Expenses.

a. Past Costs and Expenses. The Department asserts and has provided documentation to substantiate that from October 1988 through January 31, 1994, it has incurred oversight costs and expenses in the amount of Two Hundred Twenty Nine Thousand One Hundred Thirteen Dollars and Eighty Three Cents (\$229,113.83) in connection with overseeing ARCO's characterization of the Plant and development of pre-remediation work plan activities for the Areas. Within thirty (30) days of the date of this CO&A, ARCO shall reimburse the Department for these costs and expenses. The payment shall be made by two (2) corporate checks. One check shall be made payable to the "Commonwealth of Pennsylvania, Solid Waste Abatement Fund," in the amount of \$95,346.96. The other check shall be made payable to the "Commonwealth of Pennsylvania, Hazardous Sites Cleanup Fund" in the amount of \$133,766.87. Both checks shall be forwarded to Charles A. Duritsa at the address specified in Paragraph 9.b. hereof.

b. Future Costs and Expenses.

(i) ARCO shall reimburse the Department for its reasonable costs and expenses incurred as of February 1, 1994, and thereafter, provided such costs are either less than or of the same nature and magnitude as the Department's past costs for the following:

(1) the Department's review of the work plans and reports submitted by ARCO pursuant to this CO&A; and

(2) the Department's investigation and/or review of the facts concerning (A) future remediation of the Areas; (B) negotiation of one or more Consent Orders and Agreements providing for said remediation; and (C) information and data submitted in accordance with said Consent Order(s) and Agreement(s).

(ii) The Department shall use its best efforts to submit to ARCO by September 30, 1994, and every six (6) months thereafter, a detailed accounting of oversight costs and expenses incurred by the Department relating to the above-described review and investigation. The accounting shall include (i) identification of Department personnel involved with the above-described review and investigation; (ii) the number of hours devoted to the review and/or investigation performed by such individual; (iii) a general description of the review and/or investigation by such individual; and (iv) the hourly base salary and benefits costs for such individual's time. The Department will be reimbursed for its overtime personnel costs, including overhead, and travel costs. The Department will also be reimbursed for all of its expenditures to third parties for work directly related to tasks

identified in Paragraph 10.b.(i) above, and costs for analyses of samples performed for the Department either in its own laboratory or in a contract laboratory.

(iii) Within sixty (60) days of the date of an accounting by the Department, ARCO shall forward a check to the Department at the address specified in Paragraph 9.b. hereof, and made payable according to the fund identified and the specifications included in the accounting for all costs not disputed by ARCO. In addition, ARCO shall identify any disputed items which ARCO shall not be obligated to pay until it has a reasonable opportunity to meet with the Department to discuss the items in dispute. Both the Department and ARCO shall use their best efforts to resolve any dispute regarding oversight costs.

c. Payment of oversight costs by ARCO shall not be construed or interpreted as an endorsement or approval by ARCO of the activities or conclusions of the Department or the Department's consultants.

11. Stipulated Penalties. Subject to the effect of Paragraph 18 (Force Majeure), in the event ARCO fails to comply in a timely manner with any term or provision of this CO&A, ARCO shall be in violation of this CO&A and, in addition to other applicable remedies shall pay a civil penalty as follows:

a. For failure to submit a work plan pursuant to Paragraph 3.a., ARCO's response pursuant to Paragraph 3.b., a report of the results of a work plan pursuant to Paragraph 4, or the plan and schedule described in Paragraph 8.b. ARCO shall pay stipulated penalties in the following amounts for each day the delay continues.

<u>Period of Delay</u>	<u>Amount/Day</u>
1st through 10th day	\$ 500.00
11th through 20th day	\$ 750.00
21st day and beyond	\$1,000.00

b. For failure to initially commence or finally complete a work plan in accordance with a schedule approved as part of a work plan pursuant to Paragraphs 3.b., 3.d., 8.a., or 8.b, ARCO shall pay stipulated penalties in the following amount for each day the delay continues.

<u>Period of delay</u>	<u>Amount/Day</u>
1st through 10th day	\$ 250.00
11th through 20th day	\$ 500.00
21st day through 30th day	\$ 750.00
30th day and beyond	\$1,000.00

ARCO's failure to meet any interim milestone date for any subtask in an approved work plan shall not be a basis for the assessment of stipulated penalties under this CO&A.

c. For failure to pay Civil Penalties pursuant to Paragraph 9 and Oversight Costs and Expenses pursuant to Paragraph 10 hereof, ARCO shall pay stipulated penalties in the amount of \$500.00 per day.

d. ARCO shall pay stipulated penalties within thirty (30) days of receipt of written notice from the Department (the "written notice"). The Department is not obligated to assess a stipulated penalty pursuant to this CO&A. Prior to sending ARCO a written notice, the Department will send ARCO a letter advising ARCO of any failure to comply in a timely manner with any term or provision of this CO&A. This letter shall provide ARCO with a five (5) day period of time for curing its alleged failure to comply (the "five day cure period"). For the period prior to and during the five day cure period, ARCO shall not be

subject to any stipulated penalties. Stipulated penalty payments shall be forwarded as described in Paragraph 9.b. of this CO&A. It is understood by the parties hereto that payment of any money hereunder shall neither constitute a waiver of ARCO's duty to meet its obligations under this CO&A nor preclude the Department from commencing an action to compel ARCO's compliance with the terms and conditions of this CO&A, or any applicable statute, rule, regulation, permit or order of the Department. In no event will a stipulated penalty for failure to comply in a timely manner with any term or provision of this CO&A exceed the sum calculated pursuant to subsections a, b and c of this Paragraph for thirty (30) days of violations.

e. In the event that ARCO exercises its right to appeal a written final order issued by the Department pursuant to Paragraph 3.d. of this CO&A, no civil penalty shall accrue during the pendency of such appeal for matters identified in the joint dispute statement. However, stipulated penalties shall accrue for matters not identified in the joint dispute statement. Said penalty shall be payable in full within fourteen (14) days of receiving the Department's written notice of the amount of the penalty following the conclusion of ARCO's appeal either 1) by a dispositive opinion or adjudication issued by the EHB in favor of the Department, or 2) by ARCO's unilateral withdrawal of the appeal. In the event that the EHB opinion or adjudication rules partially in favor of both parties, the civil penalty shall be prorated to the extent the EHB rules in favor of the Department. In the event of an EHB order remanding matters to the Department and in the event ARCO disagrees with the manner in which the Department acts pursuant to the remand order, the parties shall follow dispute resolution procedures as described in Paragraph 3.

In the event the parties are unsuccessful in resolving differences related to the action taken by the Department pursuant to the remand order, ARCO retains its right to appeal said action in accordance with applicable procedures set forth in Paragraph 3. Civil penalties shall accrue during the pendency of said appeal and shall be payable within fourteen (14) days following the conclusion of said appeal as outlined above in this paragraph.

12. Existing Obligations Unaffected. Except as provided in Paragraphs 3, 7 and 8 herein, nothing set forth in this CO&A is intended, nor shall be construed, to relieve or limit ARCO's obligation to comply with any existing or subsequent statute, regulation, permit or order. In addition, except as provided in Paragraphs 3, 7 and 8 herein, nothing set forth in this CO&A is intended, nor shall be construed, to authorize any violation of any statute, regulation, order, or permit issued or administered by the Department.

13. Reservation of Rights by the Department. With regard to matters not addressed by this CO&A, the Department specifically reserves all rights to institute equitable, administrative, civil and criminal actions, for any past, present or future violation of any statute, regulation, permit or order, or for any pollution or potential pollution to the air, land or waters of the Commonwealth.

14. Reservation of Rights by ARCO. Except as provided in the closing Paragraph and subject to Paragraph 26, ARCO reserves all rights it may have to oppose, appeal and defend against any action by the Department and to assert any and all claims it may have against the Department or any third party. ARCO reserves the right to contest and challenge

in any action with a third party, any factual or legal allegation, finding or conclusion set forth in this CO&A.

15. Limited Waiver. As to matters addressed by this CO&A, the Department waives only (i) the right to seek civil penalties above the amounts specified in Paragraphs 9.a. and 9.d. (Civil Penalties) for the matters described therein; and (ii) the right to seek past oversight costs and expenses above the amounts specified in Paragraph 10.a. hereof. The Department reserves all other rights to institute equitable, administrative, civil and criminal actions with respect to any matter addressed by this CO&A, including the right to require additional measures, to achieve compliance with applicable law.

16. Remedies for Breach. ARCO's failure to comply with any provision of this CO&A shall be deemed a material breach, and in the event of any such breach, the Department may, in addition to the remedies prescribed herein, proceed with any action at law or in equity to bring about compliance with the applicable statutes, rules and regulations, permits, orders, and this CO&A.

17. Liability of Operator. ARCO shall inform all persons necessary for the implementation of this CO&A of the terms and conditions of this CO&A. ARCO shall be liable for any violations of the CO&A, including those caused by, contributed to, or allowed by its directors, officers, agents, managers, servants and privies and any persons, contractors and consultants acting under or for ARCO.

18. Force Majeure.

a. In the event that ARCO is prevented from complying in a timely manner with any time limit imposed in this CO&A solely because of a strike, fire, flood, act

of God, or other circumstances beyond ARCO's reasonable control and which ARCO, by the exercise of all reasonable diligence, is unable to prevent, or mitigate then ARCO may petition the Department for an extension of time. An increase in the cost of performing the obligations set forth in this CO&A shall not constitute circumstances beyond ARCO's control. ARCO expressly agrees that its economic inability to comply with any of the obligations of this CO&A shall not be grounds for any extension of time under this paragraph.

b. ARCO shall only be entitled to the benefits of this paragraph if it notifies the Department within five (5) days by telephone and within ten (10) days in writing of the date it becomes aware or reasonably should have become aware of the circumstances impeding performance. The written submission shall include all related documentation, as well as a written statement made subject to penalty for falsification by ARCO's Plant project manager specifying the reasons for the delay, the expected duration of the delay, and the efforts which have been made and are being made by ARCO to minimize the length of the delay. If an extension is granted, ARCO shall not be liable for stipulated penalties, if any apply, for the period of delay approved by the Department. ARCO's failure to comply with the requirements of this paragraph specifically and in a timely fashion shall render this paragraph null and of no effect as to the particular incident involved.

c. Within five (5) business days after receipt of ARCO's written statement, the Department will decide whether to grant all or part of the extension requested on the basis of all documentation submitted by ARCO and other information available to the

Department. Only a letter which has been signed by the Department and its counsel will constitute an extension under this paragraph.

d. ARCO shall have the burden of proof as to the justification for an extension and the length of such extension pursuant to this paragraph both to the Department and in the event that compliance with the terms and conditions of this CO&A becomes an issue in any subsequent litigation brought by the Department to enforce the CO&A against ARCO following any denial by the Department of a force majeure time extension request. Such burden of proof shall be by a preponderance of the evidence.

19. Transfer of Site.

a. The parties expressly intend that the duties and obligations under this CO&A shall not be modified, diminished, terminated or otherwise altered by the transfer of any legal or equitable interest in the Site, or any part thereof. ARCO shall serve a copy of this CO&A upon the prospective transferee of the legal and equitable interest at least thirty (30) days prior to the contemplated transfer and shall simultaneously inform the Southwest Office of the Department of such intent.

b. Even if the Department has signed a Consent Order and Agreement, Consent Decree, or a Consent Order and Adjudication, in which the transferee of an interest in the Site agrees to comply with the terms and conditions of this CO&A, ARCO's duties and obligations under this CO&A are not modified, diminished, terminated or otherwise altered. Where the Department has signed a Consent Order and Agreement, a Consent Decree, or a Consent Order and Adjudication in which a transferee of an interest in the Site agrees to comply with the terms and conditions of this CO&A, ARCO may request, in

writing, the Department to modify or terminate ARCO's duties and obligations under this CO&A. The Department's decision to modify or terminate ARCO's duties and obligations under this CO&A shall be in the sole discretion of the Department.

20. Correspondence with Department. All correspondence with the Department concerning this CO&A shall be addressed to:

Regional Director
Field Operations
Southwest Region
400 Waterfront Drive
Pittsburgh, PA 15222-4745

21. Correspondence with ARCO. All correspondence with ARCO concerning this CO&A shall be addressed to:

James Tarangelo
Business Manager
3801 West Chester Pike
Newtown Square, PA 19073

and

V. Peter Wynne
Legal Counsel
3801 West Chester Pike
Newtown Square, PA 19073

In addition, ARCO agrees that service of any notice or any legal process for any purpose under this CO&A, including its enforcement, may be made by mailing a copy by first class mail to its attorney at the above address.

22. Severability. The paragraphs of this CO&A shall be severable and should any part hereof be declared invalid or unenforceable, the remainder shall continue in full force and effect between the parties.

23. Entire Agreement. This CO&A shall constitute the entire integrated agreement of the parties. No prior or contemporaneous communications or prior drafts shall be relevant or admissible for purposes of determining the meaning or extent of any provisions herein in any litigation or any other proceeding.

24. Modifications. Except as provided in Paragraph 18.c., no changes, additions, modifications, or amendments of this CO&A shall be effective unless they are set out in writing and signed by the parties hereto.

25. Attorneys Fees. The parties agree to bear their respective attorney fees, expenses and other costs in the prosecution or defense of this matter or any related matters arising subsequent to execution of this CO&A. ARCO agrees to reimburse the Department for attorneys fees incurred by the Department prior to the execution of this CO&A only to the extent set forth in the Department's letter to ARCO dated July 30, 1993.

26. Decisions under Consent Order. With the exception of any permit decision made under the provisions of this CO&A and except as provided in Paragraphs 3, 4.a.(i.e. modification of work plan) and 8 of this CO&A, any decision which the Department makes under the provisions of this CO&A shall not be deemed to be a final action of the Department, and shall not be appealable to the Environmental Hearing Board or to any court. Any objection which ARCO may have to the decision will be preserved until the Department enforces this CO&A. At no time, however, in any action between the Department and ARCO may ARCO challenge the validity of this CO&A, or challenge the Findings set forth in this CO&A.

27. Titles. A title used at the beginning of any paragraph of this CO&A is provided solely for the purpose of identification and shall not be used to interpret that paragraph.

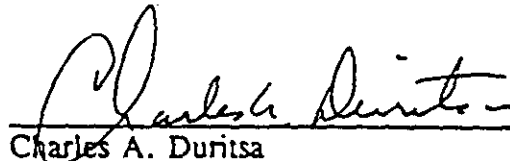
IN WITNESS WHEREOF, the parties hereto have caused this CO&A to be executed by their duly authorized representatives. The undersigned representatives of ARCO certify under penalty of law, as provided by 18 Pa.C.S. §4904, that they are authorized to execute this CO&A on behalf of ARCO; that ARCO consents to the entry of this CO&A and the foregoing Findings as an ORDER of the Department; and that ARCO hereby knowingly waives its right to appeal this CO&A and the foregoing Findings, which rights may be available under Section 4 of the Environmental Hearing Board Act, the Act of July 13, 1988, P.L. 530, No. 1988-94, 35 P.S. §7514; the Administrative Agency Law, 2 Pa. C.S. §103(a); and Chapters 5A and 7A, or any other provision of law.

FOR ARCO CHEMICAL COMPANY



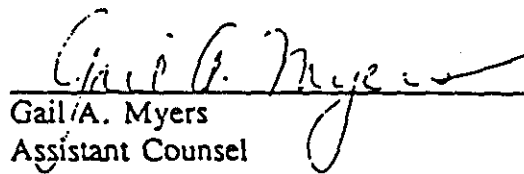
M.O. Schlanger
Senior Vice President
ARCO Chemical Company

FOR THE COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

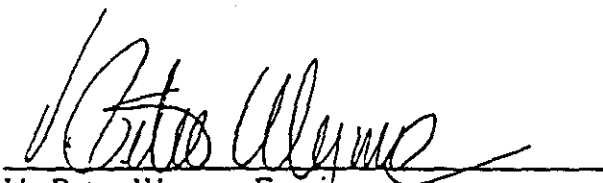


Charles A. Duritsa
Regional Director
Field Operations
Southwest Region

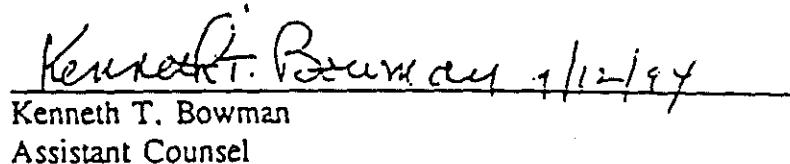
CORPORATE SEAL



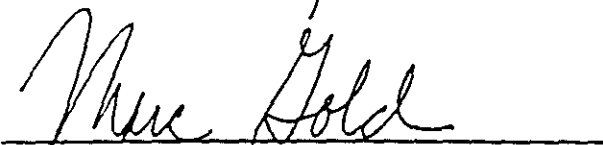
Gail A. Myers
Assistant Counsel



V. Peter Wynne, Esquire
Counsel for ARCO Chemical Company



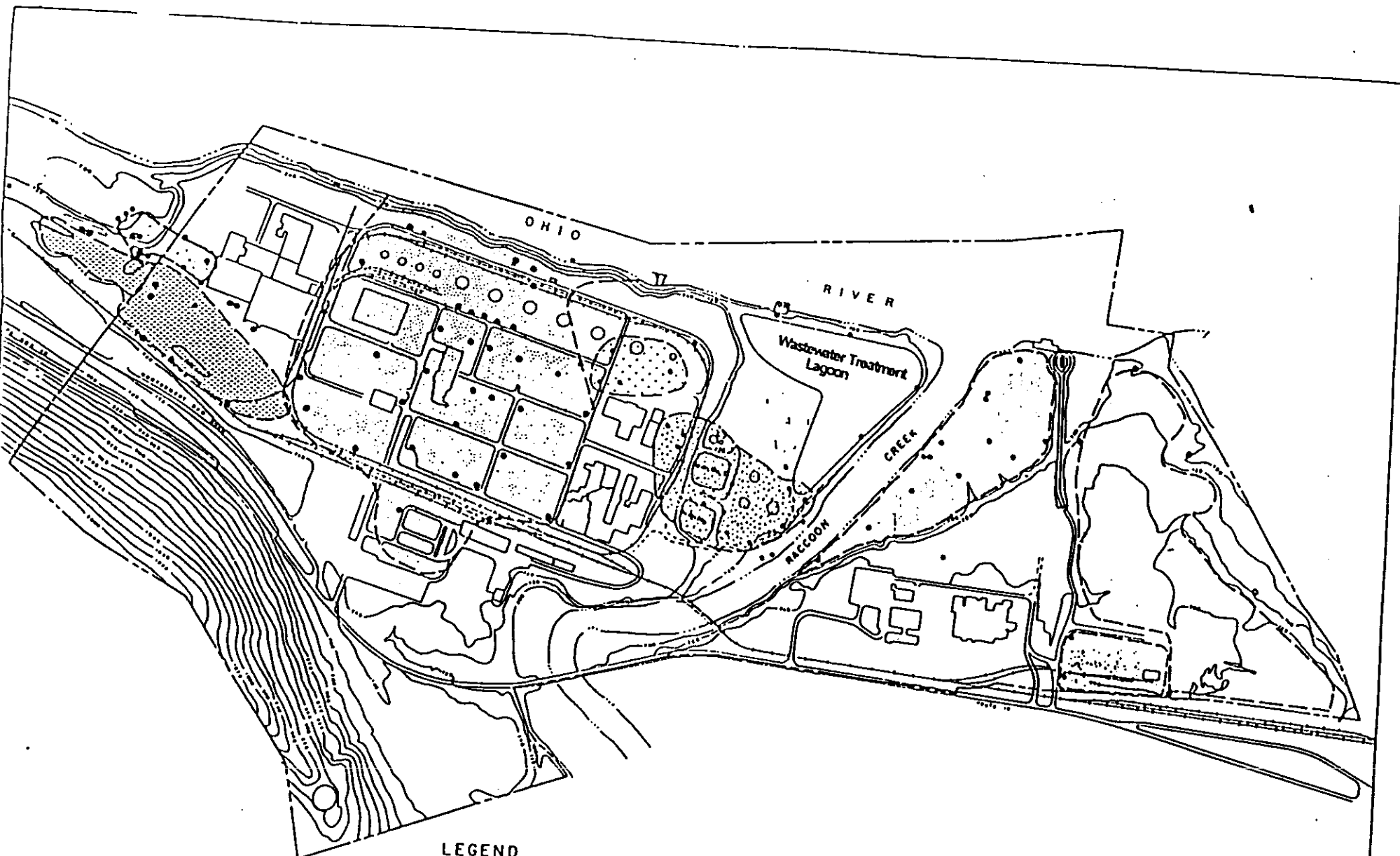
Kenneth T. Bowman
Assistant Counsel












Marc E. Gold, Esquire
Manko, Gold & Katcher

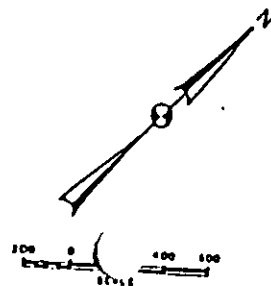
3 Attachments: Appendix A: Map
 Appendix B: Work Plan Overview for Tasks 1 through 6
 Appendix C: Department's April 11, 1994 letter

ARCO.com



LEGEND

- | | |
|--|--|
|  DRAVO QUARRY |  OVER THE HILL FARM |
|  WEST LANDFILL |  RACCOON CREEK |
|  CENTRAL PLANT AREA |  EAST LANDFILL |
|  STYRENE II AREA |  PHTHALATE PLANT AREA |
|  EXISTING MONITORING WELL | |



ARCO CHEMICAL COMPANY
BEAVER VALLEY PLANT
MONACA, PENNSYLVANIA

AREAS OF
ENVIRONMENTAL
INVESTIGATION

Applied
Hydrology

Appendix A

BEAVER VALLEY PLANT
WORKPLAN OVERVIEW
FOR
TESTING AND REMEDIAL PROCESS DESIGN

CONTENTS

TASK 1	PLANNING AND MOBILIZATION
TASK 2	SUPPLEMENTARY SITE SAMPLING
TASK 3	HYDROGEOLOGY STUDIES
TASK 4	GROUNDWATER TREATABILITY TESTS
TASK 5	SOIL VAPOR EXTRACTION
TASK 6	IN-SITU BIOREMEDIATION

Response to suggestions provided by PA DER in April 28, 1992
letter are underlined.

BEAVER VALLEY PLANT
WORKPLAN OVERVIEW
FOR
TESTING AND REMEDIAL PROCESS DESIGN

1. Task 1 - Planning and Mobilization

1.1 Contractor Review and Evaluation of
Available Site Data

The contractors who are selected to work on the project will review all currently available site data. PA DER will be informed of the name of each contractor, the duties each will perform and the data each will review.

1.2 Preparation of Detailed Work Plans

Prepare work plans for the field and laboratory tests which will be conducted in the following sequence:

Task 2 - Supplementary Site Sampling

Tasks 3 and 4 - Site Hydrogeology and Groundwater Treatability Tests (Field Test Conducted Concurrently)

Tasks 5 and 6 - Soil Vapor Extraction and In-Situ Bioremediation (Field Tests Conducted Concurrently)

- 1.2.1 Individual work plans for each of the five tasks indicated above will be submitted to PA DER for review prior to implementation. Since the results obtained from supplementary Site sampling may influence the final selection of test well locations and the scope of work for subsequent test phases, work plans for site hydrogeology, treatability tests, soil vapor extraction, and bioremediation may be amended after the supplementary site sampling task is completed.

Task 2 results will be analyzed prior to finalizing the work plans for Tasks 3 through 6. Analysis of the Task 2 data may warrant some modification.

changes, or additional activities in Task 3 through 6 work plans. Nonetheless, preliminary work plans for Tasks 3 through 6 will be submitted when the Task 2 work plan is submitted so that PA DER can complete its review in a timely manner. Implementation of the finalized work plans will proceed after resolution of comments.

- 1.2.2 The workplans will be utilized to define the scope of work of the contractors retained to implement the test program.

1.3 Safety Plan

A site safety plan for field work will be prepared in conformance with relevant sections of the OSHA regulations for hazardous waste operations and emergency response and hazard communication (29 CFR 1910.120 and 1910.1200). The site safety plan must also conform with Beaver Valley Plant safety work permit requirements.

1.4 Sampling and Analytical QA/QC

Procedures for field sampling, data collection, and analytical quality assurance will be submitted to PA DER for review prior to implementing each phase of testing.

1.5 Waste Management

Procedures for the classification, management, and disposal of waste materials generated at the site during each phase of testing will be prepared and utilized during field test work.

2. Task 2 - Supplementary Site Sampling

The purpose of supplementary site sampling is to update the information in the RI/FS reports and better define baseline conditions immediately prior to the start of

field tests. Key items to be addressed during this task include:

- (1) The location and size of NAPL layers and location of areas with elevated VOC concentrations in the soil.
- (2) The distribution of organic and inorganic materials which are solubilized in the groundwater.
- (3) The extractability of organic and inorganic materials from the soil into water and air (based upon laboratory tests with site soil samples).
- (4) The presence of native microorganisms needed for in-situ bioremediation (based upon laboratory tests with site soil samples).

2.1 NAPL Monitoring Wells and Soil Borings

Construct additional monitoring wells and/or soil borings to better determine horizontal spread and vertical thickness of NAPL layers in the Central Plant/Styrene II unit and soil VOC concentrations for:

- (1) Deep Well Area,
- (2) Nitrogen Plant Area,
- (3) Machine Shop Area,
- (4) Possible additional areas to be determined.

Specific well and boring locations to be determined. It is anticipated that wells/borings will be located in areas with the largest amounts of VOCs in soil and groundwater.

2.1.1 Existing wells used for NAPL measurement will be repaired or replaced by some of the new wells. The location and casing elevation of all wells will be surveyed.

2.1.2 During construction of bore holes, take soil core samples at elevations above and below groundwater elevation, and analyze for organic and inorganic compounds. Also analyze for geotechnical parameters such as grain size, void space, etc. This information will be used in the subsequent design of groundwater pumping tests.

- 2.1.3 Collect soil core samples and obtain biological characterization to determine presence and types of native microorganisms which can biodegrade VOCs.
- 2.1.4 Collect soil core samples for possible laboratory soil vapor extraction tests (if work for Raccoon Creek area indicates this method of testing can provide useful data).
- 2.1.5 Obtain discrete groundwater and soil samples at selected elevations in saturated zone. Analyze samples for VOCs and compute soil/water partition coefficients for VOCs.

The Task 2 work plan will indicate both the criteria to be used in determining the location of the new borings where samples will be collected as well as the depths at which the samples are to be obtained. Sampling will be done as drilling progresses. Soil and groundwater samples will be properly processed and analyzed for volatile organic compounds using an on-site lab in accordance with the Sampling and Analytical QA/QC Plan.

- 2.1.6 After new well development and equilibration, measure NAPL thickness in all monitoring wells where NAPL exists. Map vertical thickness and lateral extent of NAPL layers throughout the site. Tie-in NAPL measurements with measured groundwater elevations and Ohio River elevation.
- 2.1.7 Where sufficient volumes of NAPL can be collected from wells, analyze NAPL samples to redefine NAPL composition.

2.2 Twin Groundwater Monitoring Wells

Construct sets of twin wells, each with one well screened near the top and one well screened near the bottom of the sand and gravel unit. For example, at the Central Plant/Styrene II unit, locate one set in vicinity of Deep Well No. 1 and a second set in the vicinity of Deep Well No. 10 (exact locations to be determined). Wells screened at top of sand and gravel

unit should be screened below existing groundwater elevation so that NAPL does not enter well screen. Sample and analyze groundwater from each well for dissolved VOCs to determine possible vertical mixing.

During the development of the Task 2 work plan for the Central Plant/Styrene II Area, the contractor will examine the need for the construction of additional twin well nests located where the NAPL measured in existing wells is thickest. At each nest, one well would be screened at the water table/NAPL interface and the other well would be screened at mid-depth in the sand/gravel aquifer. The purpose of these wells would be to collect groundwater samples which could be analyzed to determine if there has been vertical migration of VOCs. Soil samples could also be taken during well construction to better define aquifer lithology. The Task 2 work plan will address the need for these additional wells and indicate the location and proposed well construction details for any additional well nests which are planned.

2.3 Groundwater Quality

- 2.3.1 If necessary, install additional groundwater monitoring wells.
- 2.3.2 Repair existing monitoring wells to allow water level measurements and sampling.
- 2.3.3 Survey location and elevation of monitoring wells.
- 2.3.4 Sample all groundwater monitoring wells. Analyze samples for VOCs in order to confirm the distribution of soluble VOC components in groundwater. Also analyze selected samples for hazardous substance list chemicals and conventional water parameters (needed for NPDES permit and design of groundwater treatment facilities).

2.4 Deep Well Flow Control and Measurement in Central Plant Area

Install a valve and flow measurement device on the discharge line from DW-1 so that groundwater withdrawal rate can be measured and controlled during subsequent groundwater pumping tests.

2.5 Install staff gauges in the Ohio River and take river elevation measurements in conjunction with groundwater level measurements and subsequent groundwater pump tests.

2.6 Conduct studies to better define the extent of bedrock in the south/southeast portion of the Central Plant/Styrene II area.

During the development of Task 2 work plans for the Central Plant/Styrene II and Over-The-Hill areas, the contractor will assess the need to better define the vertical and horizontal location of bedrock boundaries throughout these areas.

2.7 Prepare report which documents site sampling data. Submit to PA DER.

3. Task 3 - Tests to Define Hydrology (Groundwater Pumping Tests)

Relevant data collected in Task 2 will be utilized in designing the pumping tests. The conceptual model (MODFLOW) utilized previously in the Central Plant/Styrene II area will be updated based upon both the results from Tasks 2 and 3. A similar hydraulic flow model will be developed for the Over-The-Hill area utilizing the information developed in Tasks 2 and 3.

3.1 Select multiple locations in which to conduct groundwater pumping tests. Selection of locations to be based upon proximity with Ohio River, Raccoon Creek, and areas of site to be remediated. The reasons for selection of the specific pump test locations will be delineated in the work plans.

- 3.2 Construct new groundwater recovery wells at each location selected for pump tests. Also install any observation wells which are needed to measure water table drawdown and recovery during and after each test.

Observation wells will be positioned and screened at discrete depths to allow for differential hydraulic pressure or water level measurements which may identify vertical flow patterns, recharge boundaries and the river/aquifer relationship.

- 3.3 Conduct pumping test (duration to be determined) at each new recovery well to determine hydraulic conductivity, water table drawdown correlations with pumping rates, and radius of influence (data needed for design of both pumping and soil vapor processes). Pumped groundwater produced in tests will be sampled and analyzed for VOCs, and additional parameters at start and end of each test to determine concentration changes as a result of flushing.

The need to define delayed yield will be examined during the design of the pumping tests and addressed in the Task 3 work plan.

- 3.4 Evaluate the feasibility of utilizing inert tracers to better determine groundwater flushing during pump tests.

- 3.5 Utilize pumped groundwater to conduct treatability tests to identify treatment processes, define design parameters, and provide data needed for revised NPDES permit application (See Task 4).

- 3.6 Prepare report which documents hydrogeology tests. Submit to PA DER.

4. Task 4 - Field Treatability Tests for Groundwater

- 4.1 Groundwater treatability tests will be conducted concurrently with the pumping tests. Treatability

tests will be used to determine a feasible system for treating groundwater and defining design parameters for individual treatment processes.

4.2 The specific combination of treatment processes which are tested will be defined based upon the groundwater analyses contained in the RI/FS reports and data from Task 2. It is anticipated that certain processes will be tested using transportable storage tanks and treatment equipment brought to the site (e.g., air strippers, activated carbon columns) in order to treat the substantial volume of groundwater which will be produced during the pumping tests. Idle plant equipment (e.g., distillation columns, tanks) may also be utilized for this purpose. Other treatment processes (e.g., biological) may be tested on a laboratory scale utilizing samples of the produced groundwater.

4.3 The groundwater produced during the field test program, along with well development water and rinse water from the storage tanks will be treated to concentration limits agreed upon with PA DER and discharged through the plant Outfall 002 system.

4.4 Prepare report which documents treatability test results. Submit report to PA DER.

5. Task 5 - Tests to Determine Applicability and Define Design Parameters for Soil Vapor Extraction (SVE) Process

Soil vapor extraction models or other methods of analysis will be utilized in the preparation of the Task 5 work plan and the design of the SVE tests. The Task 5 work plan will indicate the reasons for selecting the locations for the SVE tests.

5.1 Select locations to conduct soil vapor extraction field tests based upon data collected in monitoring program, possible lab scale SVE tests, and previous RI/FS. For example, anticipate that SVE field tests will be

conducted at 3 locations within Central Plant/Styrene II area:

- (1) Nitrogen Plant vicinity.
- (2) DW-1 vicinity.
- (3) Machine Shop Area.

5.2 Install SVE equipment (test wells, in-ground pressure/vacuum sensors, vacuum compressor, instrumentation, and air pollution control devices) sequentially at each location, and determine the following information.

- (1) air permeability of soil (i.e., air flowrates which can be induced through sand and gravel).
- (2) radius of influence of vapor wells determined via pressure measurements and possible helium tracer studies.
- (3) initial vapor concentrations of each VOC component.
- (4) possible enhancement of VOC vapor concentrations through use of air injection above the water table, as well as air sparging beneath water table.

5.3 It is anticipated that a transportable vapor incinerator will be brought to the site and with PA DER approval, utilized to treat the air stream produced during the SVE tests.

5.4 Soil Vapor Extraction Report

Prepare report which documents SVE test results. Submit to PA DER.

6. Task 6 - Tests to Determine Applicability and Define Design Parameters for In-Situ Bioremediation

6.1 Utilize the data obtained from site monitoring (Task 2), groundwater pumping (Task 3) to finalize specific lab and field test program needed for bioremediation.

Anticipate that program will include the following tests:

- (1) Peroxide injection tests (i.e., demonstrate that aqueous hydrogen peroxide and nutrient solutions can be injected into the groundwater and transported to where contamination exists).
- (2) Analysis of water drawn from recovery wells for evidence of biological activity.
- (3) Utility of bioventing in conjunction with SVE tests.

6.2 Bioremediation Report

Prepare report which documents biotest results. Submit to PA DER.



COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

400 Waterfront Drive
Pittsburgh, PA 15222-4745
April 11, 1994

(412) 442-4000

Southwest Regional Office

Mr. James Tarangelo
Business Manager
Engineering Resins
ARCO Chemical Company
3801 West Chester Pike
Newtown Square, PA 19023

Re: ARCO Chemical Company, Beaver Valley Plant
Central Plant Styrene II and Over-the-Hill Tank Farm Areas

Department's authorization of temporary collection and treatment system
for ground water produced during field tests.

Dear Jim:

On March 28, 1994, ARCO and the Department met to discuss the terms and conditions that should govern ARCO's proposed temporary collection and treatment system for ground water produced during Task 3 (Aquifer Tests), Task 5 (SVE Tests) and Task 6 (Bioremediation Tests) for the Central Plant/Styrene II and the Over-the-Hill Tank Farm Areas ("proposed collection and treatment system). As described in ARCO's Task 4 Work Plan, ARCO intends that the treated water will be discharged through Outfall 001 to the Ohio River.

Based on the information provided in the work plan, the temporary treatment of contaminated ground water generated by these activities and its discharge to Outfall 001 are hereby approved for a period of time not to exceed a total of 4,320 hours of actual discharge. This authorization shall expire two (2) calendar years from the date of this letter, whether or not ARCO has used all the hours of discharge available under this authorization. Any treatment and discharge of pumped ground water produced during the field tests which occurs beyond this authorization will require a NPDES Permit and a Part II Water Quality Management Permit.

APPENDIX C (Five Pages)

This authorization is subject to the following conditions:

1. The discharge from the final treatment unit must comply with the effluent limits and monitoring requirements set forth on the list enclosed herewith as Attachment A.
2. The effluent analysis required shall be summarized and submitted to this office within twenty-eight (28) days following the end of each calendar month. Two copies of the summary must be sent--one to the Chief of the Permits Section of the Water Management Program, and one to the Chief of the Operations Section of the Water Management Program. A third copy should be sent to Fred Baldassare, Hydrogeologist, Environmental Cleanup Program.
3. All waste water must be conveyed through the proposed treatment system and the system must be properly operated and maintained.
4. ARCO shall be responsible for any impairment to water uses occurring as a result of this discharge. If any adverse effect results from this discharge, the Department reserves the right to require that the discharge be discontinued.
5. If there is any earthmoving activity at the Beaver Valley Plant site, adequate erosion and sedimentation control measures must be provided (Chapter 102) to prevent pollutants from soil stockpiles from entering waters of the Commonwealth (surface or groundwater).
6. Influent analysis for the parameters, frequencies and types specified in Attachment A must also be done. These samples are to be taken at the influent to the equalization tank prior to all subsequent treatment steps. ARCO may choose to do additional BTEX sampling between carbon units for operational control purposes.
7. In accordance with 40 C.F.R. §122.41, any violations of the Daily Maximum limits set forth in Attachment A for the pollutants designated with an asterisk in the left margin and any unanticipated bypass of the treatment units must be orally reported to the Department within twenty four (24) hours of the time ARCO becomes aware of such violation(s). Any other violations of this approval may be reported on a monthly basis. This does not exempt ARCO from the requirements to report incidents causing or threatening pollution as specified at 25 Pa. Code §101.2.

Any violations of the conditions contained in this approval letter may subject ARCO to all applicable penalties specified in the Clean Streams Law, 35 P.S. §691.1 et seq., June 22, 1937, P.L. 1987.

ATTACHMENT A

Discharge Parameter	Monthly Average ¹ (mg/l)	Daily Maximum ² (mg/l)	Sample Frequency	Sample Type
Total Iron	3.5	7.0	1/week	24-HC
Manganese ⁴	2.0	4.0	1/week	24-HC
*Methylene Chloride	0.005	0.01	1/week	grab
Acetone	0.034	0.068	1/week	grab
*Benzene	0.005	0.01	1/week	grab
*Toluene	0.005	0.01	1/week	grab
*Ethylbenzene	0.005	0.01	1/week	grab
Styrene	0.038	0.076	1/week	grab
Xylenes	0.010	0.02	1/week	grab
*Phenol	0.010	0.02	1/week	grab
*2,4-Dimethyphenol	0.01	0.02	1/week	24-HC
*Naphthalene	0.010	0.02	2/quarter ³	24-HC
*Diethylphthalate	0.02	0.04	1/week	24-HC
*Fluorene	0.01	0.02	2/quarter ³	24-HC
*Phenanthrene	0.01	0.02	1/week	24-HC
*Anthracene	0.01	0.02	2/quarter ³	24-HC
*Di-n-Butylphthalate	0.01	0.02	2/quarter ³	24-HC
*Bis(2-ethylhexyl)phtalate	0.01	0.02	2/quarter ³	24-HC
4-AAP Phenol	Monitor and Report		2/quarter ³	24-HC
Pyridine	Monitor and Report		1/week	24-HC
*Gamma-BHC	Monitor and Report		1/week	24-HC
2-Butanone (MEK)	Monitor and Report		2/quarter ³	24-HC
2-Methylphenol	Monitor and Report		2/quarter ³	grab
2-Methylnaphthalene	Monitor and Report		1/week	24-HC
*Arsenic	Monitor and Report		2/quarter ³	24-HC
Benzoic Acid	Monitor and Report		1/week	24-HC
			2/quarter ³	24-HC

Discharge Parameter	Monthly Average ¹ (mg/l)	Daily Maximum ² (mg/l)	Sample Frequency	Sampl Type
*Cadmium	Monitor and Report		2/quarter ³	24-H
*Chromium	Monitor and Report		2/quarter ³	24-H
*Copper	Monitor and Report		2/quarter ³	24-H
*Lead	Monitor and Report		2/quarter ³	24-H
*Nickel	Monitor and Report		1/week	24-H
*Selenium	Monitor and Report		2/quarter ³	24-H
*Silver	Monitor and Report		2/quarter ³	24-H
*Zinc	Monitor and Report		1/week	24-H
TSS	30	60	1/week	24-H
Oil and Grease	15	30	1/week	grab
Flow (gpm)	Monitor and Report		Daily	Continu
pH (S.U.)	6.0 and 9.0		1/week	grab

1. The average of all the grab sample analytical results taken during a calendar month.
 2. The analytical results of any daily sample must comply with this limitation.
 3. Both samples to be taken during the same calendar month.
 4. Monthly average concentrations which exceed 2 mg/l for three (3) consecutive months will constitute a violation of the monthly average manganese limit. Manganese concentrations which exceed 4 mg/l for three (3) consecutive daily sampling events will constitute a violation of the daily maximum manganese limit.
- * Denotes toxic pollutant designated under Section 307(a) of the Clean Water Act, 33 U.S.C §1307(a).

APPENDIX C-1
REMEDIAL INVESTIGATION SUBMISSIONS

APPENDIX C-1
ARCO BEAVER VALLEY PLANT
LIST OF STUDIES WHICH COMPRISE THE REMEDIAL INVESTIGATION INFORMATION

<u>AREA AND STUDY TITLE</u>	<u>PREPARED BY</u>	<u>DATE ISSUED</u>
<u>RACCOON CREEK AREA</u>		
Remedial Investigation/Feasibility Study Raccoon Creek Area	Applied Hydrology Assoc., Inc. Denver, CO	February 1990
Aquifer Test Results Raccoon Creek Area	ERM-EnviroClean, Inc.	June 1992
Raccoon Creek Investigation Report Findings (except Appendix B)	ICF Kaiser Pittsburgh, PA	October 1996
Groundwater Flow and Transport Evaluation Raccoon Creek Area	ICF Kaiser Pittsburgh, PA	March 1997 (Revised)
Groundwater Modeling Evaluation of a Surface Recharge Barrier Raccoon Creek Area	ICF Kaiser Pittsburgh, PA	April 1997
Estimated Inventory of Subsurface Organic Constituents	E.H. Dohnert Environmental Consulting Services Wilmington, DE	March 1994
Analytical Results of Surface Water Samples Collected From Raccoon Creek July 23, 24, 1997	ICF Kaiser Pittsburgh, PA	August 1997

AREA AND STUDY TITLEPREPARED BYDATE ISSUEDCENTRAL PLANT/STYRENE II AREA

Hydrogeologic Assessment -
Central Plant Area

Applied Hydrology Assoc., Inc.
Denver, CO

April 1989

Remedial Investigation/Feasibility Study
Styrene II Area

Applied Hydrology Assoc., Inc.
Denver, CO

April 1990

Task 2 - Supplementary Site Sampling
Report

ENSR
Pittsburgh, PA

December 1993

Task 3 - Hydrogeological Studies Report

ENSR
Pittsburgh, PA

April 1994

Estimated Inventory of Subsurface BTEXS
and Aromatic Hydrocarbon Constituents

E.H. Dohnert Environmental
Consulting Services
Wilmington, DE

January 1994

Beaver Valley Central Plant Area
Ohio River Well Point Monitoring
Program

ICF Kaiser
Pittsburgh, PA

January 1995

Summary of Analytical Results From
Encapsulated Soil Pile Sampling

David S. Smallwood & Assoc.,
Inc. for ACC/BEI Submittal

November 1996

Ohio River Well Point Monthly Reports

David S. Smallwood & Assoc.,
Inc. for ACC/BEI Submittal

January 1993 through
August 1997

Letter to Charles Duritsa, Regional
Director

Thomas J. Walsh,
ARCO Chemical Company

October 7, 1997

AREA AND STUDY TITLEPREPARED BYDATE ISSUEDOVER-THE-HILL TANK FARM AREA

Remedial Investigation/Feasibility Study	Applied Hydrology Assoc., Inc. Denver, CO	January 1990
Supplementary Groundwater Data from the Over-the-Hill Tank Farm Area	Applied Hydrology Assoc., Inc. Denver, CO	October 1991
Task 2 - Supplementary Site Sampling Report	Dames & Moore Willow Grove, PA	December 1993
Task 3 - Hydrogeological Studies Report	Dames & Moore Willow Grove, PA	April 1994
Estimated Inventory of Subsurface BTEXS and Aromatic Hydrocarbon Constituents	E.H. Dohnert Environmental Consulting Services Wilmington, DE	January 1994
Raccoon Creek Investigation Report Findings	ICF Kaiser Pittsburgh, PA	October 1996

WEST LANDFILL AND QUARRY AREA

Site Assessment - West Landfill ARCO Beaver Valley Plant	IT Corporation	February 1989
Dravo Quarry Area Investigation	IT Corporation Monroeville, PA	September 1989
Summary of Analytical Results from Soil Piles at West Landfill	David S. Smallwood & Assoc., Inc. for ACC/BEI Submittal	November 1996
Supplementary Surface Water and Sediment Sampling	ICF Kaiser Pittsburgh, PA	November 1996
Estimated Inventory of Subsurface Organic Constituents	E.H. Dohnert Environmental Consulting Services Wilmington, DE	April 1994

AREA AND STUDY TITLEPREPARED BYDATE ISSUEDEAST LANDFILL AREA

Preliminary Site Assessment of the East
Landfill Area of the Beaver Valley Plant

Wehran Engineering Corp.
Middletown, NY

August 1992

East Landfill Groundwater Flow and the
Influence of Pumping Wells at Zinc
Corporation of America

Applied Hydrology Assoc., Inc.
Denver, CO

September 1992

Subsurface Mass Estimate of Organic
Constituents for the East Landfill Area

David S. Smallwood & Assoc.,
Inc. for ACC/BEI Submittal

October 1997

PHTHALIC ANHYDRIDE PLANT

ARCO - East Parcel
Environmental Site Assessment

IT Corporation
Monroeville, PA

December 1989

Soil Core Analytical Results
Phthalic Anhydride Plant Investigation

ICF Kaiser
Pittsburgh, PA

May 1996

Estimate of Mercury Contained in Surface
Soils of Phthalic Anhydride Plant

David S. Smallwood & Assoc.,
Inc. for ACC/BEI Submittal

October 1997

PLANT PROPERTY PERIMETER

Quarterly Groundwater Monitoring Reports
and Maps

Applied Hydrology Assoc., Inc.
Denver, CO

Quarterly since 1992

ALL AREAS

Beaver Valley Plant Chronological
Summary of Remedy Selection Process

ACC/BEI

July 1997

**APPENDIX D
BEAVER VALLEY PLANT
REMEDATION PLAN OVERVIEW**

I. GENERAL

This document presents an overview of the remediation plans ARCO Chemical Co. ("ACC") and Beazer East, Inc. ("Beazer") will implement to address identified environmental conditions at a manufacturing facility known as the Beaver Valley Plant ("Plant").¹ These approved remediation plans were developed based upon an extensive review by the Parties of possible remedies for the areas of concern at the Plant. A summary of the remedy selection approach, consistent with Section 304(j) of Act 2, was reviewed and approved by the Department and is attached hereto as Appendix D-1. The timing and manner in which reports will be submitted under Act 2 to implement the remedies set forth below are contained more fully in the Consent Order and Agreement between the Parties to which this document is appended ("1997 CO&A"). The parties agree that Appendix D is subject to modification in accordance with the Department's review of the risk assessment and detailed remediation plans to be submitted by ACC and Beazer only in the event there is a material change in the underlying environmental conditions at the Plant.

In addition to providing an overview of the remediation plans for the Plant, this document identifies the manner in which ACC and Beazer will address regulated substances of concern ("RSOC") present at the Plant. Only one inorganic RSOC (elemental mercury) exists in the surface soils at the Plant. At some locations the organic RSOC are present as Separate Phase Liquids ("SPL") which float on the groundwater table. Soil sampling has shown that most of the organic RSOC exist within a soil layer approximately four feet thick which is centered at the water table. The organic RSOC may be present as a SPL, as minute liquid droplets which are held within the interstitial spaces between soil particles, and/or as constituents which have dissolved in the groundwater.

For purposes of this matter, SPL is defined as a measurable layer of volatile and semi-volatile organic compounds which exist as a separate liquid phase on the groundwater table. (The specific compounds comprising the SPL at the Plant are set forth in the various reports previously provided to the Department.) ACC and Beazer have agreed to remove SPL from specific areas at the Plant. The Department has agreed to specific criteria which will apply to determine when ACC's and Beazer's obligations to remove SPL are terminated under the 1997 CO&A.

¹A more specific description of the areas to be remediated, the remediation activities and the chemical constituents of concern are set forth fully in the Consent Order and Agreement ("CO&A") between ACC, Beazer and the Department to which this document is appended. Defined terms in the CO&A are incorporated by reference in this document as if fully set forth herein.

The Parties have agreed, for settlement purposes only, upon criteria for demonstrating attainment of Act 2 cleanup standards as they apply to groundwater. In any subsequent proceeding, after an effort to resolve their differences, the Parties reserve all rights to assert their respective positions under Act 2 regarding the applicability of surface water quality standards to the remediation activities to be undertaken at the Beaver Valley Plant.

II. IDENTIFIED AREAS OF ENVIRONMENTAL CONCERN

As set forth in Paragraph H of the 1997 CO&A, six areas of environmental concern have been identified at the Plant for remediation in accordance with the requirements of Act 2. The precise location and boundaries of these six areas are shown on the map which is attached as Appendix B to the 1997 CO&A. The six areas identified by the Parties are: (1) the Central Plant/Styrene II Area ("Central Plant Area" or "CP/SII"); (2) the Over-the-Hill Tank Farm Area ("OTH Area"); (3) the West Landfill/Dravo Quarry Area ("West Landfill Area"); (4) the Raccoon Creek Area ("Raccoon Creek Area"); (5) the East Landfill Area ("East Landfill Area") and (6) the Phthalic Anhydride Plant Area ("Phthalic Anhydride Area"). The regulated substances of concern detected in each of these six areas and the industrial activities conducted in these areas, are described more fully in Paragraph I of the Consent Order and Agreement between ACC and the Department dated July 12, 1994 ("1994 CO&A") as well as in reports provided to the Department referenced in Appendix C-1 of this 1997 CO&A.

Within the CP/SII Area and OTH Area are six discrete areas where SPL is present or otherwise where elevated concentrations of RSOC exist. These six primary areas of concern within the CP/SII Area and OTH Area are shown on Figures 1 through 5 which are attached to this Appendix D.

III. REMEDIAL ACTIONS

This section of the Remediation Plan Overview describes the general environmental conditions of each of the six areas of environmental concern, and the associated discrete areas and identifies the remedial actions for each area. In many instances the proposed remediation will address regulated substances in addition to the designated RSOC.

A. Central Plant Area

1. Summary of Environmental Conditions

The RSOC in the Central Plant area are BTEXS aromatic compounds (i.e., benzene, toluene, ethylbenzene, xylenes, and styrene). The remediation will address these constituents as well as higher molecular weight alkyl benzene compounds (e.g., diethylbenzene) and fuel oil hydrocarbons. These semi-volatile organic constituents ("SVOC") are frequently found in soils with the BTEXS constituents.

At some locations the BTEXS and SVOCs are present as SPL which exists within a soil layer approximately 4 feet thick centered about the water table.

2. Summary of Remedial Actions

The Central Plant remediation will focus upon the five discrete areas where most of the BTEXS constituents are present.

Air sparging and in-situ bioremediation will be utilized to remove BTEXS from soils and groundwater. Soil vapor extraction wells will be operated while sparging is being conducted to minimize off-site migration of vapors at one location near the Ohio River.

The remediation described below at each of the five discrete areas constitutes the extent of ACC's and Beazer's remediation obligations in the Central Plant Area under the 1997 CO&A. Each location is shown in the maps provided as Figures 1 through 5.

Individual descriptions of the remediation proposed for each discrete area follow this summary.

a. Ohio River Sparge Curtain Area

The Ohio River sparge curtain is designed to reduce the potential migration of BTEXS constituents in groundwater at the river's edge.

(1) Description of Environmental Conditions

Soils analyses obtained during the construction of sparge and water table wells indicated that ethylbenzene is the principal BTEXS constituent.

(2) Description of Remedial Action

The wells which comprise the sparge curtain are shown in the cross-section on Figure 1. The wells labeled "SPAR" are used for sparging. The wells labeled "WT" are used for soil vapor extraction ("SVE") and respiration monitoring. The wells labeled "I" are also used for respiration monitoring.

During 1995, a one-month test was conducted with the curtain operating with air sparging in combination with SVE. Throughout 1996 and continuing in 1997, the sparge curtain has been operated in the sparge/biovent mode. Sparge air aids the removal of dissolved organics present in the groundwater in the saturated zone. Oxygen contained in the sparge air promotes aerobic microorganism activity resulting in the aerobic organisms degrading the organic contaminants. Field tests have shown that the biodegradation takes place in the vadose zone soils above the water table.

During sparging, soil vapor will be extracted from the WT wells located on both sides of each sparge well. As shown in the cross-section, the sparge curtain wells are divided into four groups labeled A, B, C, and D. Each of these letter groups contains two sparge wells and four WT wells which can be used for SVE.

At the end of a sparge event, the SVE unit will be shut off when sparging is completed, and bioventing in the aerated soils will proceed in the same manner as at the other four locations.

During the time period of remediation, quarterly sampling will be conducted to measure the groundwater elevation relative to mean sea level ("MSL"). Both groundwater elevation and the top of the SPL layer will be measured to the nearest 1/8" in accordance with Appendix D-2. Dissolved oxygen and alkalinity in the groundwater will also be measured. In addition, respiration rates (oxygen depletion/carbon dioxide production) and total volatile organic compound ("TVOC") concentrations will be determined from soil vapor samples. The monitoring points for this area are the wells labeled WT and I in Figure 1.

(3) Duration of Remediation

Subject to the provisions of Section IV hereof, the Sparge Curtain will be operated with SVE and bi-weekly sparging for a period of two years from the effective date of the 1997 CO&A.

b. Location 1

(1) Description of Environmental Conditions

The "Location 1" bioremediation area is a rectangle whose dimensions encompass the monitoring wells in which a SPL layer has been measured south of Tank 5, and the wells with elevated BTEXS soil concentrations at the water table. The dimensions of the rectangle are determined by setting MW-203S as the western boundary, MW-32 as the southern boundary, MW-18 as the eastern boundary, and MW-16 as the northern boundary. The boundaries of the bioremediation area are shown in Figure 2.

(2) Description of Remedial Action

A sparge/biovent system will be constructed by placing one new sparge well adjacent to MW-203S, and a second new sparge well west of MW-32 at Underpass Road. Existing deep wells MW-204M or 204D and MW-18A will also be used as sparge wells. This creates a system of four sparge wells. The sparge and monitoring wells which comprise sparge/bioremediation system for Location 1 are shown on Figure 2. Each sparge well will be sparged once per week.

During the time period of remediation, weekly sparging and quarterly sampling will be conducted to measure the groundwater elevation (relative to MSL). Both groundwater elevation and the top of the SPL will be measured to the nearest 1/8" in accordance with Appendix D-2. Dissolved oxygen and alkalinity in the groundwater will also be measured. In addition, respiration rates (oxygen depletion/carbon dioxide production) and TVOC concentrations will be determined from soil vapor samples. A total of 12 monitoring points will be used as shown on Figure 2.

(3) Duration of Remediation

Subject to the provisions of Section IV hereof, the sparge system will be operated for a period of two years.

c. Location 2

(1) Description of Environmental Conditions

The "Location 2" bioremediation area is a rectangle whose dimensions encompass the monitoring wells MW-165 and 208S where SPL has been measured. The dimensions of the rectangle are determined by setting MW-165 as the southern boundary, MW-209S as the northern boundary, a line running between these two wells as the eastern boundary, and MW-208S as the western boundary. The boundaries of the bioremediation area are shown in Figure 3.

(2) Description of Remedial Action

A sparge/biovent system will be constructed by placing one new sparge well near MW-165, and a second new sparge well near MW-208S. Either existing well MW209M or 209D will also be used as a sparge well. This creates system of three sparge wells. The sparge and monitoring wells which comprise the sparge/bioremediation system for Location 2 are shown on Figure 3. Each of the sparge wells will be sparged once per week.

During the time period of remediation, weekly sparging and quarterly sampling will be conducted to measure the groundwater elevation (relative to MSL). Both groundwater elevation and the top of the SPL will be measured to the nearest 1/8" in accordance with Appendix D-2. Dissolved oxygen and alkalinity in the groundwater will also be measured. In addition, respiration rates (oxygen depletion/carbon dioxide production) and TVOC concentrations will be determined from soil vapor samples. A total of eight monitoring points will be used as shown on Figure 3.

(3) Duration of Remediation

Subject to the provisions of Section IV hereof, the sparge system will be operated for a period of two years.

d. Location 3

(1) Description of Environmental Conditions

The Location 3 bioremediation area is a trapezoid whose dimensions encompass the wells MW-27, 29, 31 and 205S where SPL has been measured. The locations of these wells are shown in Figure 2.

(2) Description of Remedial Action

A sparge/biovent system will be constructed by placing three new sparge wells on a line running between MW-27 at the north end, and the midpoint between MW-29 and 31 at the south end. The first sparge well would be located near the pipe rack midway between MW-29 and 31. The second would be located at the south wall of Fire Station No. 2 on Fifth Street. A new monitoring well would be installed 50-75 feet east of this sparge well. The third sparge well would be located approximately 50 feet SE of MW-27 on Fifth Street. The sparge and monitoring wells which comprise the sparge/bioremediation system for Location 3 are shown on Figure 2. Each sparge well will be sparged once per week.

During the time period of remediation, weekly sparging and quarterly sampling will be conducted to measure the groundwater elevation (relative to MSL). Both groundwater elevation and the top of the SPL will be measured to the nearest 1/8" in accordance with Appendix D-2. Dissolved oxygen and alkalinity in the groundwater will also be measured. In addition, respiration rates (oxygen depletion/carbon dioxide production) and TVOC concentrations will be determined from soil vapor samples. A total of five monitoring points will be used as shown on Figure 2.

(3) Duration of Remediation

Subject to the provisions of Section IV hereof, the sparge system will be operated for a period of two years.

e. Location 4

(1) Description of Environmental Conditions

The Location 4 bioremediation area is a rectangle with MW-211 as the NW corner, MW-212 as the SW corner, and MW-213S and 39 as the south border. (Note

that the bedrock rises above the water table to the east of MW-39.) The locations of the wells are shown in Figure 4.

(2) Description of Remedial Action

A sparge/biovent system will be constructed using existing wells 211D and 212D as sparge wells. One new sparge well will be installed approximately 200 feet west of 212D and 75 feet north of MW-39. This placement forms a triangular pattern with the two existing sparge wells. One new monitoring well will be installed 50 feet NE of the new sparge well. The sparge and monitoring wells which make up the sparge/bioremediation system for Location 4 are shown on Figure 4. Each sparge well will be sparged once per week.

During the time period of remediation, weekly sparging and quarterly sampling will be conducted to measure the groundwater elevation (relative to MSL). Both groundwater elevation and the top of the SPL will be measured to the nearest 1/8" in accordance with Appendix D-2. Dissolved oxygen and alkalinity in the groundwater will also be measured. In addition, respiration rates (oxygen depletion/carbon dioxide production) and TVOC concentrations will be determined from soil vapor samples. A total of ten monitoring points will be used as shown on Figure 4.

(3) Duration of Remediation

Subject to provisions of Section IV hereof, the sparge system will be operated for a period of two years.

B. The OTH Area

1. Summary of Environmental Conditions

The regulated substances of interest are BTEXS aromatic compounds. The remediation will address these constituents as well as higher molecular weight SVOCs such as alkyl benzene compounds (e.g., diethylbenzene). These SVOCs are frequently found in soils with the BTEXS constituents.

Soil sampling has shown that most of the BTEXS and SVOC constituents exist in sub-surface soils at the water table.

2. Summary of Remedial Actions

a. Objectives of the Remedy

The remediation will focus upon the discrete area where most of the BTEXS constituents are present. Air sparging and in-situ bioremediation will be utilized to

remove BTEXS from the soils and groundwater near the water table at the former location of Tanks 4 and 5.

The remediation described below at this location constitutes the extent of ACC's and Beazer's remediation obligations for the OTH area under the 1997 CO&A. This location is shown in the area map provided as Figure 5.

b. Description of the Remedial Action

A sparge/biovent system will be constructed utilizing selected wells from the group of sparge wells which have already been installed within the berms surrounding the former location of Tank 5, as well as one new well. The new sparge well will be installed within the north-east corner of these berms. Existing wells located within the Tank 5 berms will be used for SPL monitoring.

Three new sparge wells, each with a companion monitoring well, will be installed at the midpoint along the inside slopes of the east, west, and north berms surrounding former Tank 4. As shown in Figure 5, the former location of Tank 4 and its surrounding berms is directly north of former Tank 5.

An additional new sparge well will be installed east of the Tank 4 berms near existing monitoring well MW-115. This new sparge well will be positioned to treat BTEXS constituents in groundwater which flows toward it from berm soils surrounding a tank which was located adjacent to Raccoon Creek.

The wells which comprise the sparge/biovent system for the OTH Area are shown on Figure 5.

Based upon 1995 field test results each of the nine sparge wells will be sparged on a two-week cycle.

During the time period of remediation, bi-weekly sparging and quarterly sampling will be conducted to measure the groundwater elevation (relative to MSL). Both groundwater elevation and the top of the SPL will be measured to the nearest 1/8" in accordance with Appendix D-2. Dissolved oxygen and alkalinity in the groundwater will also be measured. In addition, respiration rates (oxygen depletion/carbon dioxide production) and TVOC concentrations will be determined from soil vapor samples. A total of 19 monitoring points will be used as shown on Figure 5.

3. Duration of Remediation

Subject to the provisions of Section IV hereof, the sparge system will be operated for a period of two years.

C. West Landfill Area

1. Summary of Environmental Conditions

The West Landfill Area is comprised of three smaller sub-areas: the West Landfill, the former Dravo Quarry, and the Pond. Active remediation activities are required to be undertaken only at the West Landfill.

Samples of the Pond water do not contain detectable concentrations of regulated substances of concern in concentrations above applicable Statewide Health Standards. Groundwater samples from the saturated sand and gravel layer north west of the landfill and the quarry have never shown detectable concentrations of regulated substances of concern.

BTEXS constituents such as benzene and ethylbenzene, and poly-nuclear aromatic hydrocarbons have been found in samples of groundwater and fill material in the West Landfill, and at some locations in the silty clay around and under the Pond located to the west.

The southern boundary of the West Landfill Area is a fairly steep terrace where erosion has exposed waste materials such as polystyrene solids, construction debris, and trash.

Five soil piles which contain pieces of concrete, asphalt, and wood floor tiles collected during site preparation for new plant buildings have been placed at the West Landfill. The volume of the soil piles is estimated to be approximately 500 cubic yards. The material in the piles has been sampled and tested for various site specific organic constituents. No such constituents are present at levels in excess of the Act 2 Statewide Health Standards for soil. The material in the soil piles will be placed in the West Landfill as part of the remediation of the area.

Approximately 2800 cubic yards of soil and material associated with a containment cell which is located in the Central Plant Area will also be placed in the West Landfill as part of the remediation of the area. This material has also been sampled and analyzed for site specific organic constituents. No such constituents are present at levels in excess of the Act 2 Statewide Health Standards for soil.

2. Summary of Remedial Actions

The cover on the West Landfill will be recontoured and up-graded. The waste materials which are visible at the southern terrace will be removed, and either replaced within the landfill, or sent to an off-site disposal facility. A more gradual-sloped terrace at the southern boundary will then be created. This will be done by cutting existing cover material back at the top of the existing slope, and using material from the previously referenced soil piles as fill at the base of the existing slope. The remainder of the West Landfill will be re-graded with gradual slopes toward the perimeter. A layer of top-soil will be placed over the

ground surface. Disturbed areas will be seeded and planted so as to provide an effective and permanent vegetative cover.

3. Duration of Remediation

The remediation of the West Landfill Area will be completed in accordance with the schedule set forth in the 1997 CO&A. Revegetation will be considered to have been successfully completed when disturbed areas have at least seventy percent (70%) ground cover of permanent plant species.

D. East Landfill Area

1. Summary of Environmental Conditions

Various sites within the East Landfill Area were used as disposal facilities for plant wastes. In the late 1980's all of the disposal sites were closed, covered with fill and top soil, and seeded with grass. The ground surface at the East Landfill Area presently consists of a series of natural and man-made terraces with established vegetation.

Groundwater monitoring wells located along the eastern property boundary have been sampled quarterly and analyzed for BTEXS constituents for the past seven years. These wells have never shown concentrations of RSOC which exceed the Statewide Health Standard medium specific concentration.

2. Description of Remedial Action

The former disposal sites within the East Landfill Area will be inspected according to a schedule agreed upon with the Department. Locations with evidence of accelerated erosion or significant subsidence will be re-graded and covered with imported clean fill and top-soil. The recontoured ground surface will then be hydro-seeded so as to maintain the vegetative cover.

3. Duration of Remediation

The East Landfill Area will be regularly inspected. Activities to address subsidence or erosion from the former disposal sites will continue for no longer than ten years in accordance with the post remediation care plan.

E. Raccoon Creek Area

1. Summary of Environmental Conditions

The RSOC are BTEXS aromatic compounds, specifically benzene. Benzene is present in both the sub-surface soils and groundwater in this area.

2. Description of Remedial Action

The existing vegetative cover over the Raccoon Creek Area will be maintained to ensure at least a 70% ground cover of permanent plant species.

The Raccoon Creek Area will be regularly inspected. Activities to address subsidence or erosion from former disposal sites will continue for no longer than ten years in accordance with the post remediation care plan.

3. Duration of Remediation

Surface water samples from Raccoon Creek will be collected for 12 consecutive quarters commencing in July, 1997 (i.e., stream samples will be collected in October, February, May and August of each year). Transects C, D and E, the downstream locations nearest to the Raccoon Creek Area, are the approved transects for purposes of demonstrating attainment of the Act 2 cleanup standards for groundwater. The locations of those three transects are shown in Figure 6.

Water samples will be collected during each sampling event at approximately the same three locations along Transects C, D and E which were sampled in July, 1997. That is, samples will be collected at the center of the stream, and approximately 30 feet from the east and west banks: at the center location, samples will be collected at three depths: 6 inches below the surface, 1 to 2 inches above the bottom, and midway between the surface and bottom. Samples from the east and west sides of the transect will be collected at two depths: 1 to 2 inches above the bottom, and midway between the surface and bottom. Samples will be collected using a peristaltic pump following the same procedures utilized during the July 1997 sampling.

4. Attainment Demonstration

For purposes of the attainment demonstration for the Raccoon Creek Area, attainment of an Act 2 cleanup standard will be demonstrated if the benzene concentration in 90% of the samples collected from Transects C, D and E is less than or equal to 5 PPB for four consecutive quarters and no sample exceeds 10 PPB. EPA test method 524.2 will be used for sample analysis. The analytes will be limited to BTEXS compounds. Following the demonstration of attainment as described above, quarterly sampling will be conducted only at Transect E for the remainder of the 12 quarters.

If after 12 quarters of sampling attainment has not been demonstrated then the Parties shall meet to evaluate the data. The meeting can be initiated by any signatory party.

F. The Phthalic Anhydride Area

1. Summary of Environmental Conditions

Based upon environmental investigations of the Phthalic Anhydride Area conducted over the last several years, the RSOC is mercury. Mercury is present in surface soils in concentrations that will be addressed as part of a remediation plan under Act 2.

2. Summary of Remediation Actions

Mercury impacted surface soils will be excavated and either staged in an appropriately lined and covered soil storage area prior to off-site disposal, or loaded directly into appropriate vehicles for immediate shipment off-site. Potential remediation alternatives under investigation for the mercury impacted soils include: (a) recovery of the mercury from the soil in an off-site recovery system; and (b) off-site disposal at an authorized facility.

3. Duration of Remediation

The time required to complete the remedy will vary from several weeks to several months depending on the volume of impacted soils encountered during remediation and constraints imposed by the off-site disposal facility and/or the off-site recovery facility.

IV. TERMINATION OF SPL REMOVAL ACTIVITIES

ACC and Beazer shall perform the remediation activities set forth in Paragraphs III.A.2 and III.B concerning SPL removal for the time periods described in the Duration of Remediation sections thereof. The Parties agree that ACC and Beazer may terminate these activities after these time periods expire. In addition, ACC and Beazer may petition the Department to cease SPL removal activities in any area pursuant to the 1997 CO&A prior to the specified expiration dates if no SPL has been measured at agreed upon monitoring points in such area(s) for a minimum of four quarters. (The sampling protocols used to measure SPL at SPL monitoring points are set forth in Appendix D-2). The Department may request that ACC and Beazer continue the remediation activities described in Paragraphs III.A.2 and III.B and any such area(s) pursuant to the 1997 CO&A beyond the time periods set forth herein if SPL continues to be measured at the monitoring points in such area(s). Any disagreement between the Parties concerning termination of SPL removal activities shall be subject to the Dispute Resolution Provision in Paragraph 12 of the 1997 CO&A. Post remediation monitoring shall continue in accordance with any Post Remediation Care plans.

APPENDIX D

FIGURES

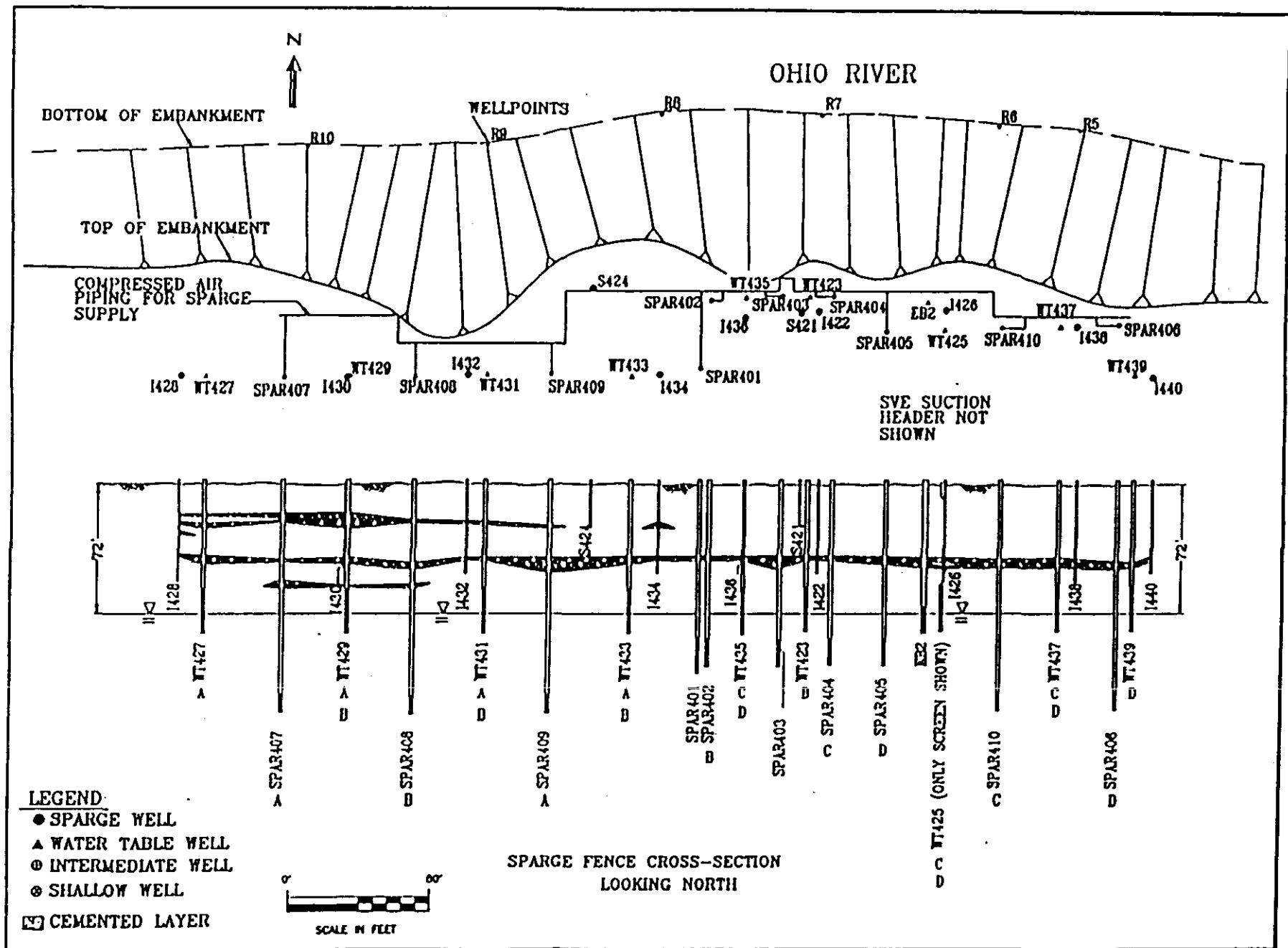


FIGURE 1: OHIO RIVER SPARGE CURTAIN WELLS

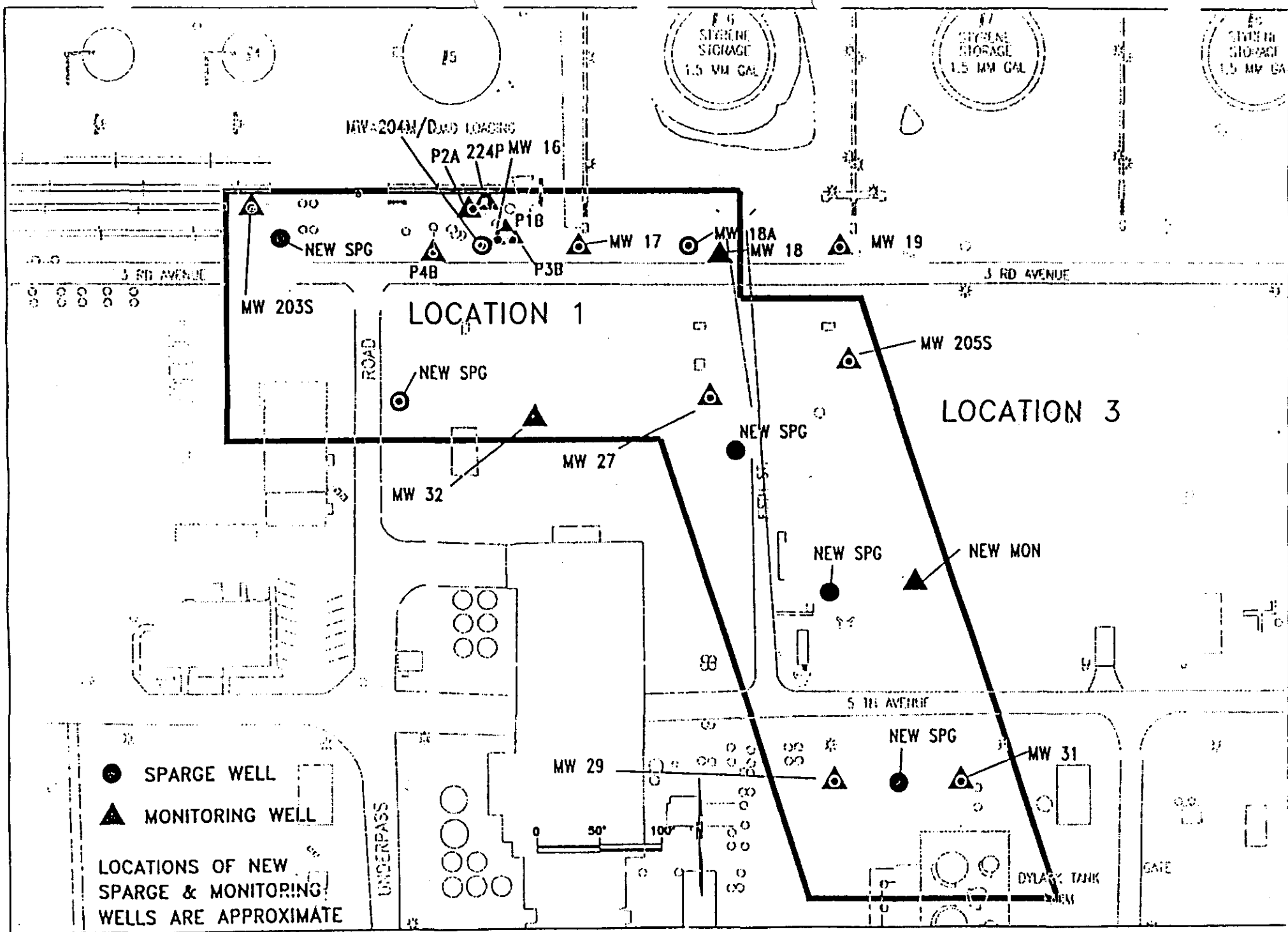


FIGURE 2: CENTRAL PLANT LOCATIONS 1 & 3

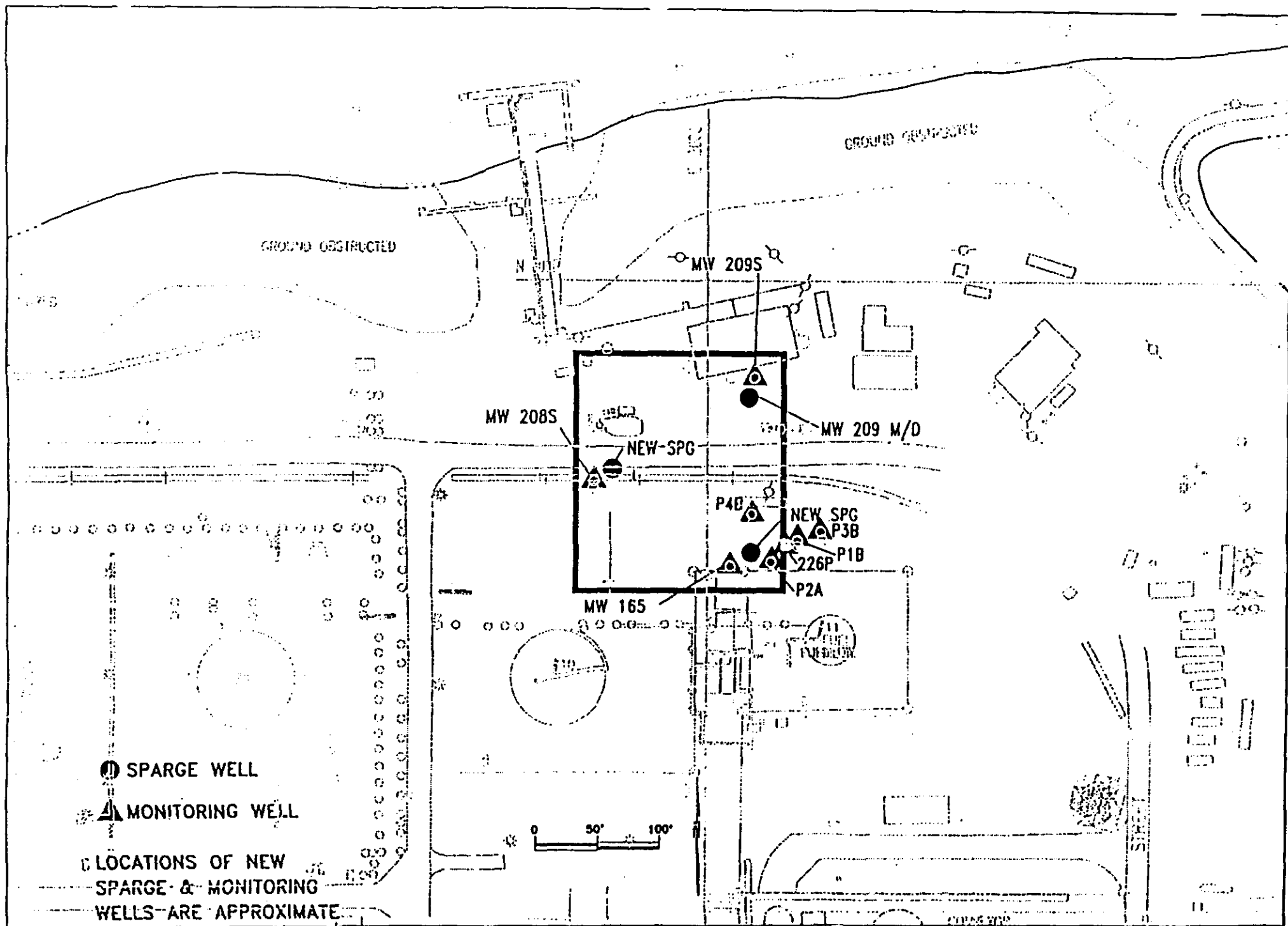


FIGURE 3: CENTRAL PLANT LOCATION 2

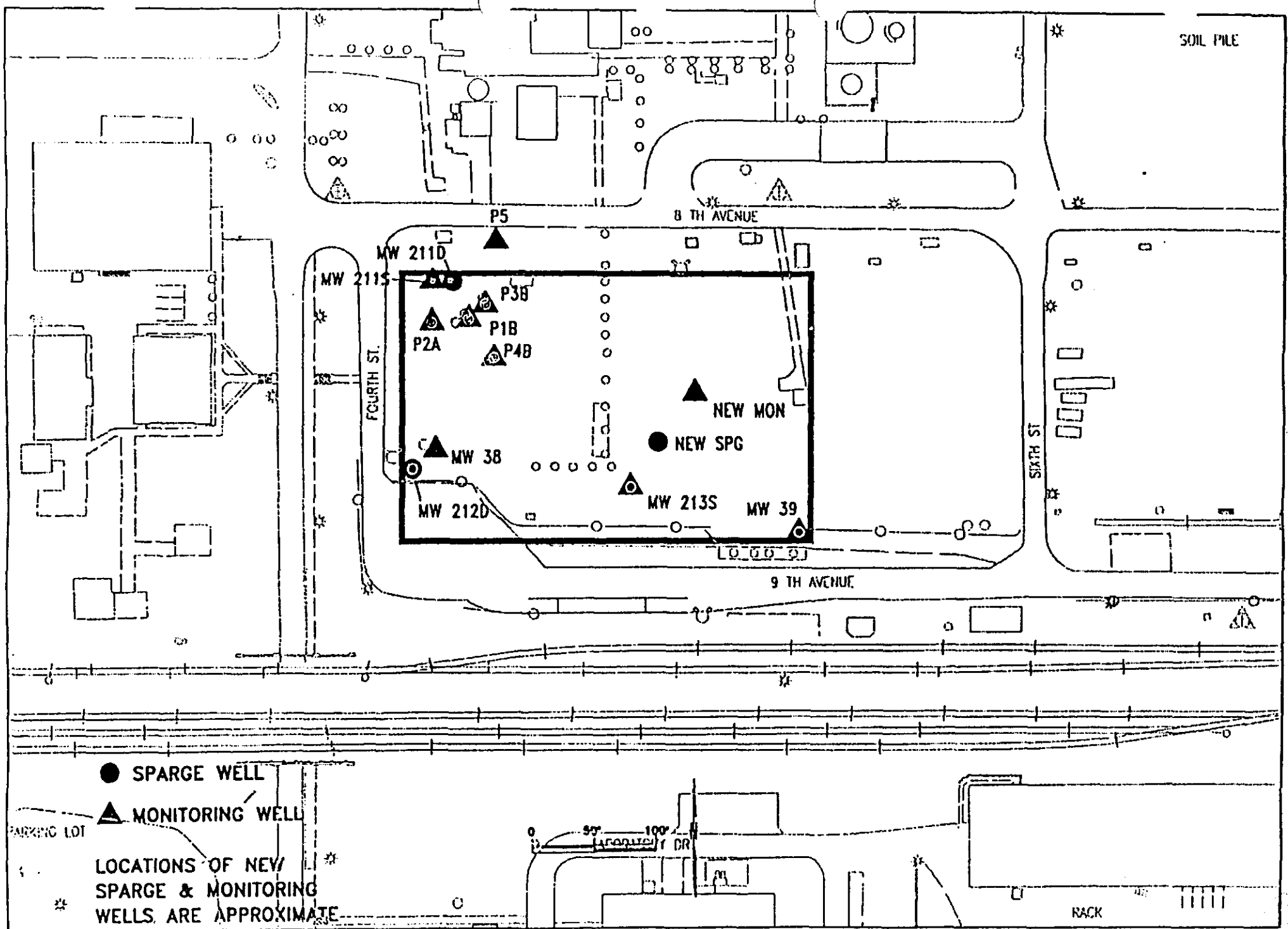


FIGURE 4: CENTRAL PLANT LOCATION 4

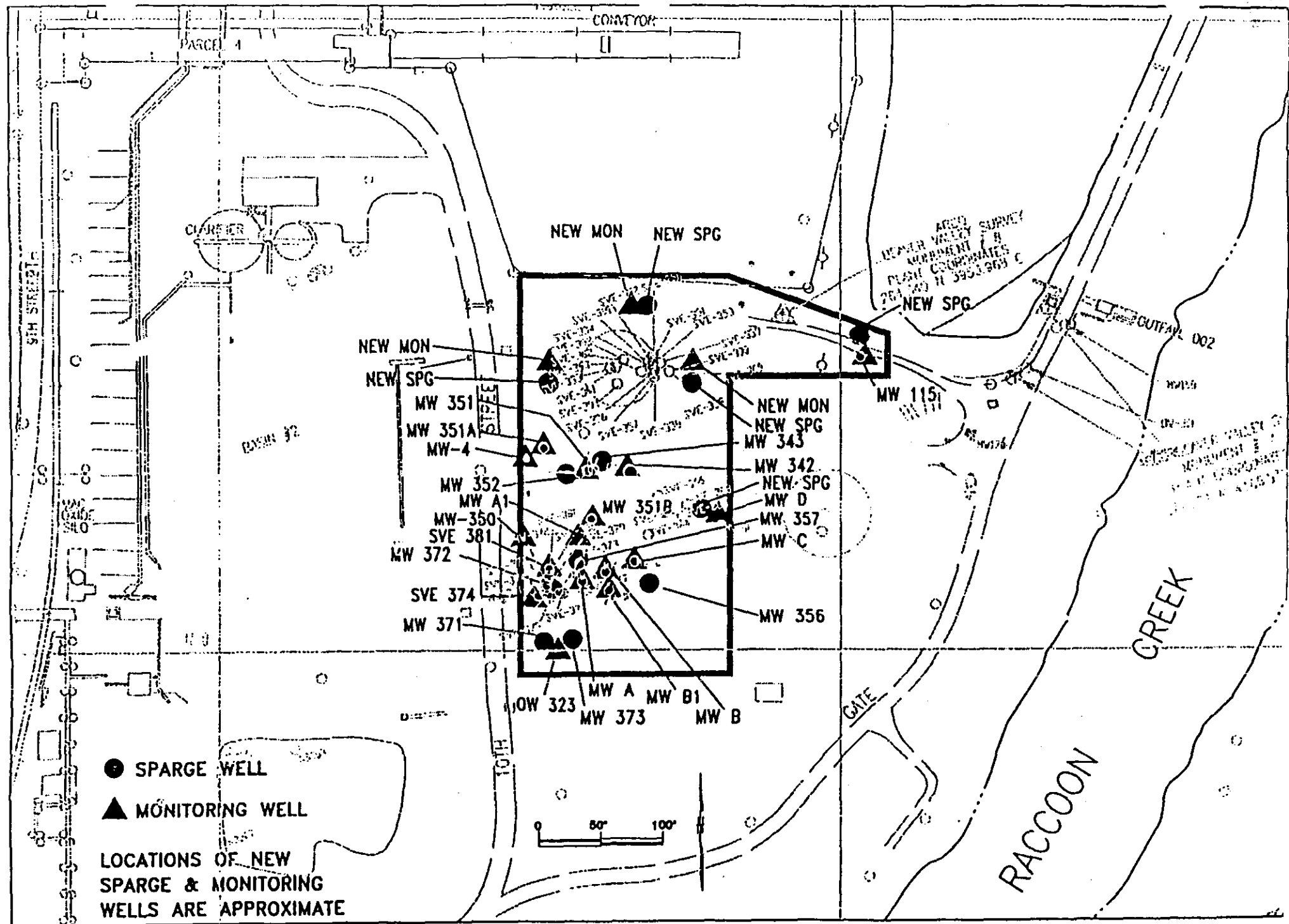


FIGURE 5: OTH (REA - FORMER TANK) & 5 LOCATION

APPENDIX D-1

304(j) ANALYSIS

APPENDIX D-1

SITE-SPECIFIC STANDARD REMEDY SELECTION BASED ON SECTION 304(j) SELECTION CRITERIA

I. BACKGROUND

Section 304 of Act 2 requires that remedies selected to meet a site-specific standard ("SSS") must consider, among other things, the following statutory factors set forth in Section 304(j): (1) long term risks and effectiveness of the remedy; (2) potential for reduction in toxicity, mobility or volume of regulated substances; (3) short term risks and effectiveness of the remedy; (4) ease or difficulty of implementing the remedy; (5) cost of the remedy; and (6) an analysis of incremental costs and benefits of the remedy. This document applies these factors to the remedies selected by ACC and Beazer that are approved by the Department in Appendix D of this Consent Order and Agreement ("CO&A").

As set forth in greater detail in this CO&A, ACC and Beazer have identified six areas within the Beaver Valley Plant which are contaminated with regulated substances of concern ("RSOC") at levels that exceed the statewide health standard ("SHS") under Act 2. (These six areas are shown on the map in Appendix B of this CO&A.) ACC and Beazer propose to remediate RSOC at five of the areas according to the SSS. Two of these areas, the Central Plant ("CP") and Over the Hill Tank Farm ("OTH") areas, are locations where historic product spillage will be addressed by source removal as set forth in this CO&A. Three of the areas, the West Landfill ("WLF"), East Landfill ("ELF") and Raccoon Creek ("RC") Area, are former solid waste disposal locations which will be addressed by in-place closure as set forth in this CO&A. (The remaining area, the Phthalic Anhydride Area, will be remediated to the SHS and is not evaluated further in this document because Section 304(j) does not apply to SHS cleanups.)

ACC and Beazer have evaluated several remedies potentially applicable to the conditions at the five areas evaluated in this document under Section 304(j). Through the extensive studies implemented under the 1994 CO&A, ACC and Beazer prepared a document entitled "*Beaver Valley Plant Chronological Summary of Remedy Selection Process*" dated July, 1997, listed in Appendix C-1 which contains a detailed summary of potential remedies evaluated by ACC and Beazer.

II. WASTE DISPOSAL FACILITY REMEDY SELECTION

A. Remedy Selected for the ELF, WLF and RC Area

As set forth in greater detail in the 1994 CO&A and in the documents listed in Appendix C-1 of this CO&A, (1) the WLF was used for waste disposal until it was closed in

1972; (2) the RC Area was used for waste disposal, including the placement of a fly ash cover, until it was closed in 1975; and (3) the ELF was used for waste disposal until it was closed in 1986. The RC Area and WLF are not subject to the SWMA closure requirements and the ELF was closed under Department guidelines.

ACC and Beazer have selected in-place closure as their site-specific remedy under Act 2 for these three waste disposal areas. The proposed remedy provides for pathway elimination by eliminating exposure from inhalation and ingestion of the RSOC by maintaining earthen caps and a cover that meets a 70% vegetative standard. SSS for groundwater will be achieved at appropriate points of compliance in accordance with Act 2 criteria. The proposed site-specific standard remedies for these three areas are described in Appendix D. Because of the nature of the in-place closure remedy, a post remediation care plan, as necessary, will be prepared and submitted to the Department in accordance with the terms and conditions of this CO&A.

**B. Application of Section 304(j) Factors to the Remedies
Selected for the RC Area, ELF and WLF**

1. Long Term Risks and Effectiveness of the Remedy

The preferred long term remedy for historical disposal areas such as the RC Area, ELF and WLF is in-place closure and containment of any contaminated groundwater. Few risks remain from in-place closure of the RC Area, ELF and WLF because the most obvious pathways of contamination (inhalation and ingestion of wastes and groundwater) are eliminated by institutional controls and caps over the surface of the areas. The post remediation care required to maintain the area is minimal insofar as it is generally limited to inspecting the condition of the earthen cap after the vegetative cover is established.

2. Potential for Reduction in Toxicity Mobility or Volume of RSOC

In-place closures do not result in the direct reduction of the toxicity or volume of waste that clean closure achieves. However, in-place closure effectively limits the mobility of regulated substances by reducing leachate produced from surface water infiltration into the waste, which also aids in the containment of contaminated groundwater.

3. Short Term Risks and Effectiveness of the Remedy

The in-place closure of contaminated materials will pose only negligible risks while still being protective of human health and the environment. On the other hand, clean closure would require the excavation of in-place cap materials, buried waste materials and soils. The excavated materials would have to be temporarily staged on-site, and ultimately sent to either a permitted off-site disposal facility or a new on-site landfill created for this purpose. Furthermore, large-scale excavation is economically and technologically infeasible and poses increased short-term risks to human health and the environment.

4. Ease or Difficulty of Implementing the Remedy

In-place closure of the RC Area, ELF and WLF is nearly complete except for some additional work as described in Appendix D and the development of post remediation care plans to assure proper maintenance of any engineering and institutional controls. ACC and Beazer will include post remediation care plans, as necessary, in the Final Report as part of demonstrating attainment of the SSS under Act 2.

5. Cost of the Remedy

Raccoon Creek Area

Prior costs incurred at the RC Area amount to \$3.5 million. These costs include site characterization studies and field tests of remedial methods including soil vapor extraction, groundwater pumping and surface treatment and the installation of thirty soil borings. The field tests demonstrated that implementation of any of the tested remedial approaches would provide limited environmental benefit.

Estimated costs for completing the in-place closure of the RC Area, and post remediation care cost for inspection and sampling, as necessary, are as follows:

Inspection and Maintenance of Cover Materials	\$ 25,000/year
Quarterly Surface Water Sampling in Raccoon Creek (Three Transects)	\$ 100,000/year

East and West Landfill Areas

Prior costs incurred at the ELF amount to \$860,000 and include site characterization studies and maintenance of the existing vegetative cover.

Prior costs incurred at the WLF amount to \$3.5 million. These costs include site characterization studies and the purchase of an adjacent property.

Estimated costs for completing the in-place closure of the ELF and WLF, and post remediation care costs for inspection and sampling, as necessary, are as follows:

Inspection and Maintenance of Cover Materials	\$ 50,000/year
Groundwater Monitoring	\$ 25,000/year
Maintenance of Monitoring Wells	\$ 5,000/year

6. Cost Benefit of the Selected Remedy to Other Proposed Remedies

It is estimated that clean closure of the landfills would generate approximately three million tons of soil and waste material which would require off-site disposal or replacement in a new on-site landfill.

Excavation, stabilization of materials removed from near the water table and interim staging prior to off-site disposal could cost \$20 per ton. Using a cost of \$75 per ton for off-site disposal as residual wastes gives a total cost of \$285 million to remove the materials to accomplish clean closure. This does not include the cost for treatment of residual soil and groundwater, and the substantial additional long term liability associated with off-site disposal.

Excavation, stabilization and interim storage of three million tons of soil and waste material prior to placement in an on-site landfill could cost \$60 million. The construction of an on-site residual waste landfill would require a facility capable of accepting approximately 2.5 million cubic yards of stabilized material. An area of approximately 150 acres would be required to contain this material assuming two 6 foot lifts. Based upon data from various landfills, the Department uses a cost estimating factor of \$350,000 per acre which covers a cap, underliner, leachate treatment and groundwater monitoring. An estimated cost of \$52.5 million for the landfill is obtained by using this factor and an area of 150 acres.

The cost for excavation and on-site replacement would be about \$113 million, again not including any costs for treatment of residual soil and groundwater at the original disposal sites.

The costs estimated in the previous section for in-place closure clearly provide a much more cost effective approach for remediation of the three areas in the manner set forth in Appendix D, while, at the same time, achieving a remedy that is protective of human health and the environment consistent with Act 2.

III. REMEDY SELECTION FOR HISTORICAL RELEASES

A. Remedy Selected for CP and OTH

Generally, remedies to address historical contamination due to spills of RSOC involve source removal of contaminated soil and groundwater, as well as separate phase liquids

("SPL") contamination on or above the water table. Physical removal of SPL and RSOC in soils and groundwater by a variety of viable in-situ extraction techniques are commonly used to remediate larger spills. Groundwater remediation is aimed at achieving applicable standards at selected points of compliance that are usually along the property line of the affected facility. In some cases, the selected points of compliance are adjacent to a surface water so that maintenance of the surface water standard is ensured when a diffuse groundwater discharge of a regulated substance to a surface water is present.

ACC and Beazer, based on extensive pilot testing at the Beaver Valley Plant, selected in-situ removal of RSOC from soils through removal of SPL at CP and OTH to a level of technical feasibility via bioventing. The remedy is described in more detail in Appendix D and, following implementation, will be subject to a post remediation care plan, as appropriate.

**B. Application of Section 304(j) Factors to the Remedies
Selected for CP and OTH**

1. Long Term Risks and Effectiveness of the Remedy

The preferred long term remedy for historical releases of RSOC at operating facilities is in-situ removal of SPL and achievement of groundwater standards at points of compliance. Few risks remain after in-situ removal of SPL because the source of the soil and groundwater contamination is removed and there are no pathways of exposure. Act 2 standards are attained on-site and surface water standards are maintained off-site. The remedy selected has been enhanced by the installation of product containment measures around operating tanks and transfer points to reduce future spillage of materials.

2. Potential for Reduction in Toxicity, Mobility or Volume of RSOC

In-situ removal of SPL results in the direct reduction of toxicity, mobility and volume of RSOC in a manner which minimizes the generation of a solid waste.

3. Short Term Risks and Effectiveness of the Remedy

The short term risks of using in-situ SPL RSOC removal techniques are minimal compared with gross media removal techniques because both exposure routes and the generation of solid wastes are minimized. The use of in-situ bioventing is intended to convert RSOC in the ground to carbon dioxide and water vapor which are not environmental contaminants. Any BTEXS emitted to the atmosphere as a result of the bioventing will meet the requirements of the Air Pollution Control Act and the SSS as described more fully in Appendix E.

4. Ease or Difficulty of Implementing the Remedy

The in-situ removal and bioremediation of SPL at CP and OTH can be implemented quickly and in a manner which is not disruptive of plant operations based on the results of pilot and field testing. The locations of the air sparging and monitoring wells have already been selected and approved by the Department in this CO&A. Considerable work already has been completed in certain areas of the Beaver Valley Plant to accomplish this remedy.

5. Cost of the Remedy

Prior costs incurred for site characterization studies, groundwater and surface water monitoring and field testing of potential remedies at the CP and OTH areas, amount to approximately \$16,000,000. Estimated capital and annual operating and maintenance costs for the sparge/biovent/SVE systems to be utilized in the CP and OTH areas are as follows:

Capital Cost (1997 \$)	\$1,500,000
Annual O&M Cost	\$1,400,000/year
Quarterly Groundwater Monitoring	\$ 50,000/year

6. Analysis of Incremental Costs/Benefits of Remedy
Selected Compared to Other Proposed Remedies

Groundwater pumping and treating in the CP and OTH areas was estimated to require a total pumping rate of 1,000 GPM or 1.5 million gallons per day. Using generalized correlations for wastewater treatment, it is estimated that a groundwater treatment system would cost \$15 million to install. O&M costs for such a system could range from \$1 million to \$3 million per year and the system would have to operate for an indefinite period of time.

The cost estimates presented in the previous section for the in-situ remedial action indicate that such actions are clearly more cost effective and will achieve a remedy that is protective of human health and the environment consistent with Act 2.

APPENDIX D-2

SPL THICKNESS MEASUREMENT PROTOCOL

APPENDIX D-2
PROTOCOL FOR SEPARATE PHASE
LIQUID THICKNESS DETERMINATION

Separate Phase Liquid ("SPL") thickness will be determined by means of an electronic sensor attached to a tape which is lowered into the well. The sensor head contains two crystals, which generate an electrical voltage when subjected to pressure, a conductivity sensor and a sub-miniature electronic circuit. The piezo-electric crystals detect liquids and the conductivity sensor detects conductive liquids (water). These devices work in conjunction with each other to differentiate between water and hydrocarbon liquid phases. This type of device has been utilized at the site for the determination of SPL thickness in monitoring wells for several years and has provided reproducible measurements. The SPL thickness is determined according to the following procedure:

1. The sensor is lowered into the well and if SPL is encountered, a specific signal is emitted. The operator then slowly retrieves the sensor until the signal stops. At this point, the operator has found the upper level of SPL in the well. Reading the tape at a specific reference point at the top of the well provides the distance to the top of the SPL.
2. The sensor is then lowered slowly back into the liquid until the signal changes from hydrocarbons to a different signal for water. The sensor is again slowly retrieved until the signal changes back from water to hydrocarbon. The operator has now found the interface between the water and the floating SPL layer in the well. A second tape reading provides the distance to this interface.
3. The first reading (SPL) is subtracted from the second reading (SPL interface with water) to give the apparent SPL thickness in the well.

The device described here is manufactured by MMC International Corporation and is designated Model No. 24012EE100 "FLEXI-DIP ENVIRONMENTAL ENGINEERING TAPE."

The vendor indicates that tape measurements can be obtained with an accuracy of plus or minus 1/8 inch (i.e., the tape can be read to the nearest 1/8 inch). The calculated SPL thickness, which is the difference of two tape measurements, has an accuracy of plus or minus 1/4 inch.

The accuracy of the tape measurements also establishes a lower detection limit of 1/4 inch for SPL thickness determinations. This detection limit equates to 0.003% of the tape measured distance based upon the 72 ft. distance between ground surface and the water table in the Central Plant Area.

APPENDIX E APPLICABLE REGULATORY REQUIREMENTS

I. GENERAL

ARCO Chemical Company ("ACC") and Beazer East, Inc. ("Beazer") have proposed to undertake certain remediation activities at a manufacturing facility known as the Beaver Valley Plant.¹ ACC, Beazer, and the Department of Environmental Protection (the "Department") have evaluated the environmental regulatory programs applicable to these remediation activities. As set forth below, the Department has agreed to use its authority under the Solid Waste Management Act ("SWMA"), Clean Streams Law ("CSL"), Air Pollution Control Act ("APCA") and their respective implementing regulations as well as its authority under Section 902(b) of the Pennsylvania Land Recycling and Environmental Remediation Standards Act ("Act 2") to grant ACC and Beazer waivers of specific permits or other potentially applicable requirements in order to allow for a timely and efficient remediation of the Plant. The following is a description of applicable operational standards and requirements which the parties agree will apply to the remediation activities.

II. SOLID WASTE MANAGEMENT ACT

The Parties recognize that the remediation of the Plant will potentially involve activities which involve the generation, processing, treatment, storage or disposal of solid waste as those terms are defined under the SWMA and implementing regulations. As set forth in greater detail below, certain soils, groundwater and other materials which ACC and Beazer will manage as part of the remediation may be classified as solid wastes. To the extent that these materials may be classified as solid wastes, the Department has determined that those potential solid wastes identified below, are generally exempt from specific permitting and/or otherwise applicable operational standards under the SWMA and Act 2 except as identified in this Appendix E. Waste materials which may be encountered during the remediation include residual wastes, as defined under 25 Pa. Code Chapter 287.1, or characteristic hazardous wastes, as defined pursuant to 25 Pa. Code Chapter 261, Subchapter C. The Department has determined that there are no solid wastes identified in Part II.A below that will be generated and managed as part of the remediation at the Plant which are regulated as "listed" hazardous wastes pursuant to 25 Pa. Code Chapter 261, Subchapter D.

¹ A more specific description of the areas to be remediated, the remediation activities and the chemical constituents of concern are set forth fully in the Consent Order and Agreement ("CO&A") between ACC, Beazer and the Department to which this document is appended. Defined terms in the CO&A are incorporated by reference in this document as if fully set forth herein.

A. Potential Solid Wastes

The following materials, which may be classified as residual or hazardous wastes, are expected to be generated by the remediation activities conducted by ACC and Beazer or have been previously generated as part of the remediation of the Plant by ACC and Beazer:

1. Drill cuttings associated with the development of soil borings and/or groundwater wells;
2. Purge water or other wastewater collected from groundwater wells;
3. Condensate from Soil Vapor Extraction ("SVE") wells;
4. Separate Phase Liquid ("SPL") collected in groundwater wells at the Plant;
5. Soil Piles previously identified to the Department located in the vicinity of the Styrene II and the West Landfill areas of the Plant;
6. Contaminated soils generated as part of earthmoving activities associated with the remediation of the Plant;
7. Mercury and related chemical constituents recovered from the remediation of the former Phthalic Anhydride area of the Plant;
8. Debris collected as part of earthmoving activities associated with remediation activities at of the East Landfill, West Landfill or otherwise discovered as part of the remediation of the Plant.

B. Approved Waste Management or Beneficial Use Activities

The following are the only regulatory requirements under the SWMA applicable to the management of materials handled as part of the remediation at the Plant described under Section II.A above.

1. Management of potential wastes associated with soil boring activities and groundwater well development, operation and sampling
 - a. Hazardous Waste Management Obligations
 - (1) If the composition of the material is unknown, ACC and Beazer shall evaluate the material to determine if it is a characteristic hazardous waste in

accordance with the requirements of 25 Pa. Code 261, Subchapter C. If the material is determined to constitute a characteristic hazardous waste, ACC and Beazer shall comply with the requirements set forth in Section II.B.(1)(a)(3), below.

(2) If the material is determined not to be a characteristic hazardous waste, the material will be evaluated pursuant to II.B.(1)(b), below, to determine residual waste requirements.

(3) In the event that the material is determined to be a characteristic hazardous waste, ACC and Beazer shall comply with the following requirements, as applicable:

(a) Store hazardous waste in accordance with the generator accumulation requirements of 25 Pa. Code §262.34.

(b) Transport and dispose of hazardous waste at an "off-site" permitted facility in accordance with the requirements of 25 Pa. Code §262.12 through §262.33.

(c) Maintain records and reports of hazardous waste generator activities in accordance with applicable requirements of 25 Pa. Code §262.40, §262.41, §262.42, §262.43 and §262.46(c).

b. Residual Waste Management

(1) If the composition of the material is unknown, ACC and Beazer shall evaluate the material in accordance with the analytical methods set forth at 25 Pa. Code §287.54(c) and determine if the material qualifies as clean fill pursuant to the Department's Clean Fill Policy, as that policy may be amended from time to time.

(2) If the material qualifies as clean fill, it may be used as part of the remediation activities, used for on-site construction activities or otherwise returned to the areas of the Plant; or used off-site without a SWMA permit pursuant to 25 Pa. Code §287.101(b)(6). The requirements of 25 Pa. Code Chapter 288 will not apply.

(3) If the material does not qualify as clean fill then the following will apply:

(a) Wastewater - Wastewater may be collected, treated and discharged through NCI's existing wastewater treatment facility (see Section III, below) provided that the wastewater does not cause a violation of applicable effluent

limitations as set forth in NCI's NPDES permit and otherwise complies with the requirements of 25 Pa. Code §§287.102(a)(2)(i), 287.102(c)(1), and 287.102(c)(2)(i).

(b) Contaminated Soils - Soils from borings promptly returned to the area of the boring will not be considered solid waste generation or disposal provided that the soil is not placed in the bore hole in a manner which would cause groundwater contamination. If the soil is transferred off-site for disposal, the regulations applicable to such activities shall apply.

(4) Maintain records at the Plant or other location approved by the Department of residual waste disposed of at off-site facilities for five (5) years after the waste is transferred from the Plant.

2. Management of Contaminated Soils

a. Soil Piles - The soil piles identified in Paragraph II.A (5) above which have been analyzed and determined to meet the Statewide Health Standard medium-specific concentrations for soils established under Act 2 have been approved by the Department for beneficial use as fill as part of the closure of the West Landfill Area of the Plant. A SWMA permit is not required by the Department pursuant to 25 Pa. Code §287.101(d). The provisions of 25 Pa. Code Chapter 288 will not apply provided that remediation of the West Landfill is conducted in accordance with the clean-up plan approved by the Department as part of the Act 2 site specific remedy.

b. Soils disturbed by Earthmoving Activities - As part of the remediation activities, earthmoving activities will disturb soils impacted by releases of chemical constituents. The Department has determined that the on-site management of soils disturbed by earthmoving activities will not be considered the generation, treatment, processing or disposal of solid waste within the meaning of the SWMA.

c. Soils Subject to In-situ Treatment Activities - Remediation activities at the Plant may include in-situ technologies that remove contaminants from soil or groundwater. The Department has determined that the operation of such in-situ remediation technologies will not be considered the generation, treatment, processing or disposal of a solid waste within the meaning of the SWMA.

d. Soils Subject to Other On-Site Processes - Remediation activities at the Plant may include an on-site mercury processing/treatment recovery system to address the presence of mercury in soils. The Department has determined that the on-site storage and treatment of mercury-contaminated soils as part of the remediation of the Plant qualifies for either a residual waste Permit-By-Rule under 287.102(h), if processing of residual waste is employed; or a hazardous waste Permit-By-Rule under 266.90, if hazardous waste

treatment is employed. Remediated soil meeting Statewide Health Standards may be used for fill or cover material within the Plant.

3. Management of Debris Collected During Remediation Activities

Other materials may be discovered during the remediation at the Plant that are not otherwise identified above including buried pieces of plastic, metal or wood covered with contaminated soils ("remediation debris"). ACC and Beazer may elect to use the remediation debris as fill material in the West Landfill Area pursuant to 25 Pa. Code § 287.101(d), as part of an approved Final Cleanup Plan, provided that such material is not a characteristic hazardous waste. The provisions of 25 Pa. Code Chapter 288 will not apply provided that remediation of the West Landfill Area is conducted in accordance with a clean-up plan approved by the Department as part of the Act 2 site specific remedy. Otherwise, the remediation debris may be disposed of at a permitted off-site disposal facility.

III. CLEAN STREAMS LAW

A. Point Source Discharges

As set forth in Section II above, wastewater may be generated as a result of the development and operation of groundwater wells at the Plant. The Clean Streams Law generally prohibits the discharge of any industrial wastewater without a permit. To the extent that ACC and Beazer discharge wastewater as a result of remediation activities, such discharge may be directed to the wastewater treatment facility at the Plant operated by NCI pursuant to NPDES Permit No. PA 0204579, in accordance with 25 Pa. Code §§92.7 and 92.51, provided that such discharge does not exceed 5,000 gallons per quarter and does not cause a violation of the effluent limitations set forth in the NPDES permit. (If it is determined that the discharge will cause a violation of the effluent limits in the NPDES permit, an amendment to NCI's NPDES permit must be obtained). No wastewater which is determined to be characteristic hazardous waste may be discharged through NCI's wastewater treatment system. In the alternative, ACC and Beazer may discharge nonhazardous wastewater through outfalls specifically designated in NCI's NPDES permit for wastewater generated as part of the remediation activities at the Plant with NCI's agreement or ACC or Beazer may acquire these outfalls from NCI in accordance with the requirements of 25 Pa. Code Chapter 92.

B. Erosion and Sedimentation Control Measures

ACC and Beazer shall conduct earthmoving activities associated with remediation in such a manner that prevents accelerated erosion in accordance with applicable requirements of 25 Pa. Code §102.1 through 102.24.

IV. AIR POLLUTION CONTROL ACT

A. Emissions from Soil and/or Groundwater Treatment Systems

The APCA requires that a person obtain a permit prior to construction or operation of an air contamination source. Soil and/or groundwater treatment systems operated as part of the remediation of the Central Plant and Over-The-Hill Areas identified in Appendix B could be classified as air contaminant sources requiring a construction or operating permit under the APCA. An estimate of the emissions of volatile organic compounds ("VOCs") from stack and fugitive air-contaminant sources resulting from the operation of the remediation systems at the Central Plant and Over-The-Hill Areas has been reviewed by the Department ("Emissions Estimate"). The Emission Estimate, which is attached hereto and labeled Appendix E-1, specifically evaluates the primary regulated substances of concern in the affected area, namely Benzene, Toluene, Ethylbenzene, Xylene and Styrene, collectively known as "BTEXS", each of which is a hazardous air pollutant or "HAP" under the APCA. Based upon a review of this Emissions Estimate and a description of the remediation systems in Appendix D for the Central Plant and Over-The-Hill Areas, the Department has determined that these remediation systems are not major stationary sources of air contamination under the APCA. Furthermore, the Department has determined that VOC and HAP fugitive emissions from these remediation systems are of minor significance pursuant to 25 Pa.Code §123.1 (a)(9). The Department has also determined that ACC and Beazer need not obtain a plan approval or operating permit under the APCA in order to construct or operate the soil and groundwater remediation systems identified in Appendix D for the Central Plant and Over-The-Hill Areas. This plan approval exemption is authorized pursuant to 25 Pa. Code §127.14(a)(8) and item 29 of the Plan Approval and Operating Permit exemption list published at 26 Pa. Bulletin, 4559 (September 21, 1996). This plan approval exemption is contingent upon ACC and Beazer meeting the performance, operational, and ambient standards of 25 Pa. Code §§123.1(c), 123.2, 123.13, 123.21, 123.31, 123.41, 131.2, and 131.3 for these air-contaminant sources.

B. Fugitive Emissions Associated with Earthmoving

As set forth in Section II above, ACC and Beazer will conduct earthmoving activities as part of the remediation of the Plant. These earthmoving activities may generate fugitive emissions of air contaminants to the ambient air to the extent that soils have been impacted by releases of chemical constituents. Fugitive emissions associated with remediation activities, after appropriate controls as set forth below, will be of minor significance with respect to causing air pollution and will not interfere with attainment or maintenance of applicable air quality standards. (See Appendix E-2.) Consequently, the Department has authorized ACC and Beazer to conduct earthmoving activities as part of the remediation without first obtaining a permit to construct or operate an air contaminant source under the APCA pursuant to 25 Pa. Code §127.14(a)(8) and item 39 of the Plan Approval and Permit

Exemption published at 26 Pa. Bulletin 4559 (September 21, 1996) provided that the fugitive dust emissions meet the performance, operational and ambient standards of 25 Pa. Code §§123.1(c), 123.2 and 123.31, 131.2 and 131.3.

APPENDIX E-1

**BEAVER VALLEY PLANT
AIR EMISSION ESTIMATES
FOR APPROVED REMEDIATION SYSTEMS**

**ESTIMATE OF VOLATILE ORGANIC COMPOUND EMISSIONS
ASSOCIATED WITH THE OPERATION OF THE
REMEDIAL SYSTEM AT THE OHIO RIVER SPARGE CURTAIN AREA**

1. Operation of the Sparge Curtain Utilizing Air Sparging in Combination with Soil Vapor Extraction (SVE) and Bioventing

The SVE System (which includes the thermal oxidizer) will be in operation during the time that air sparging is being conducted. When air sparging is completed the SVE System will be shut off, and bioventing in the aerated smear zone and vadose zone soils will continue as in the sparge/biovent mode of operation.

Sparging will be conducted over three consecutive days every two weeks. Information relevant to a typical sparge event is summarized as follows:

Duration: 3 consecutive days

Each of four pairs of sparge wells will be sparged once each day for three consecutive days.

Sparge rate per well = 300 SCFM

Total sparge flow = 300 SCFM per well x 2 wells = 600 SCFM

Sparge time = 120 minutes (2 hours) per pair of wells per day x 4 pairs of wells = 8 hours per day

The sparge system will be in operation approximately 8 hours each day during a sparge event.

The operation of the SVE System (including the thermal oxidizer) is summarized as follows:

One specific water table (WT) well will be operated in SVE service with each pair of sparge wells.

Vapor Extraction Rate Per WT Well = 300-400 SCFM

Total Vapor Extraction Flow = 300-400 SCFM per WT well x 4 WT wells = 1200 to 1600 SCFM

SVE Time: The SVE System will be in operation approximately 8 hours each day for 3 consecutive days while sparging is occurring.

The 2000 SCFM (maximum of 1600 SCFM from the SVE System plus excess air) Thermal Oxidizer Gas Treatment Unit will be utilized as part of the SVE System. This unit has been operated previously in field tests at the Central Plant and Over-the-Hill Areas.

The combustion chamber of the Thermal Oxidizer will operate with a 1700°F set point.

After three consecutive days of sparging with SVE, a zone of aerated groundwater, soil and soil-vapor will have been created at the water table and in the soil above the water table. Aerobic biological reactions will then proceed to convert the BTEXS aromatic compounds in the soil to carbon dioxide and water until the next sparge/SVE event.

2. Estimate of BTEXS Emissions

As a result of experience with the current sparge/biovent operation, BTEXS concentrations in the extracted soil vapor should be reduced from the levels seen in the September 1995 sparge/SVE tests. Table 1 below indicates the maximum BTEXS concentrations measured in the soil vapor to date:

TABLE 1
ESTIMATED BTEXS CONCENTRATION IN SOIL VAPOR

Constituent	Concentration in Soil Vapor (PPMV)	Concentration in Feed to Thermal Oxidizer (PPMV)
Benzene	40	32
Toluene	90	72
Ethylbenzene	350	280
Xylenes	20	16
Styrene	<u>10</u>	<u>8</u>
Total BTEXS	510	408

As indicated in Section 1 the soil vapor extraction rate will vary between 1200 and 1600 SCFM. The total vapor feed rate to the thermal oxidizer will be constant at approximately 2000 SCFM with the addition of dilution air through an interlocked valve system. The concentration of BTEXS in the feed to the thermal oxidizer will be reduced by a ratio of 4:5 (1600:2000) due to the addition of excess air. Calculations based upon the BTEXS concentrations in the feed to the thermal oxidizer as shown in Table 1 and 2000 SCFM vapor flow (including dilution air), provide the basis for an estimation of maximum BTEX emissions. These estimates are shown in Table 2.

TABLE 2
BTEXS EMISSION ESTIMATE FROM THERMAL OXIDIZER

Vapor Flowrate:	2000 SCFM
BTEXS Feed Concentration:	See Table 1
Combustion Temperature:	1700°F
BTEXS Destruction Removal Efficiency (DRE):	99%
Sparges:	26 sparge events per year 2000 SCFM x 60 min. per hr. x 8 hrs. per day x 3 days per sparge event = 2.9 million SCF of vapor feed per sparge event

<u>Constituent</u>	<u>Emission</u>	
	<u>Lbs/Hr</u>	<u>Lbs/Yr.</u>
Benzene	0.008	5.2
Toluene	0.022	13.9
Ethylbenzene	0.100	62.3
Xylenes	0.006	3.6
Styrene	<u>0.0028</u>	<u>1.8</u>
	0.138	87.2 (.04 tpy)

The 99% destruction removal efficiency shown in Table 2 is based upon stack test data submitted to the Department on December 9, 1994.

BTEXS emissions estimated in Table 2 should decline during the two year operation proposed for the sparge curtain if the quantity of BTEXS remaining in the soil is reduced.

**ESTIMATE OF VOLATILE ORGANIC COMPOUND EMISSIONS ASSOCIATED
WITH THE OPERATION OF THE REMEDIAL SYSTEM
IN THE CENTRAL PLANT AREA AT LOCATIONS 1, 2, 3 AND 4**

1. Remediation Utilizing Air Sparging in Combination With Bioventing

A total of thirteen sparge wells will be utilized at the four locations referenced above where sparging will be conducted in the Central Plant Area.

During 1995 air/helium gas tracer tests conducted at Locations 2 and 4 indicated that air would travel a distance of approximately 100 feet in a radial direction from a sparge well (1). These tests also indicated that sparge air did not rise any further than 20 feet above the water table in the pore space of the vadose zone soils. In the Central Plant Area the water table is 72 feet below the ground surface. Thus, sparge air did not rise to a level higher than 52 feet below the ground surface during the tests which indicates little potential for fugitive emissions to emanate from the subsurface contamination deeper than 52' during the sparge event.

Soil vapor monitoring wells located within the 100 foot radius of influence of a sparge well, and screened up to 20 feet above the water table gave measurable respiration rates in terms of oxygen consumption and carbon dioxide production. These tests defined a "vadose zone bio-reactor" surrounding each sparge well. The reactor is shaped like a porous cylinder whose radius is 100 feet and height is 20 feet. The measured porosity of the sand and gravel soil near the water table in the Central Plant Area is 30%. This gives a bio-reactor pore volume of 188,000 cubic feet.

The total volume of air introduced through a sparge well during a typical "sparge event" will be equal to the bio-reactor pore volume of 188,000 cubic feet (at standard conditions). This volume of air will be introduced at each well at rates between 400 to 600 SCFM in a 5 to 8 hour period every week.

After sparging, a zone of aerated groundwater, soil and soil-vapor will have been created within an approximate 9400 square foot circular area surrounding each sparge well. Aerobic biological reactions using indigenous microorganisms and the oxygen in the sparge air within this zone (i.e., the bio-reactor) will then convert the BTEXS aromatic compounds in the soil and groundwater to carbon dioxide and water during the one week period between sparges. This week-long quiescent period was determined from respiration tests which indicated that the oxygen contained in the sparge was consumed in one week. The bioventing process described here is repeated after each sparge.

2. Emission Estimate

The total weekly volume of sparge air injected into the subsurface around the thirteen sparge wells is 2.44 million SCF (13 X 188,000). As indicated in Section 1, the sparge air remains at least 50 feet below the ground surface during sparging. Subsequent weekly sparges will displace the air from previous sparges in a radial direction outward away from the sparge well. This displacement will ultimately lead to soil vapor being released from the subsurface at locations which are removed from the individual sparge wells. The soil vapor which is released will be a mixture of sparge air and air from the pore space of soil which is outside the radius of influence of the sparge wells. Because of the radial travel path of the sparge air, the soil vapor which is released at the surface will have resided in the subsurface for several weeks.

BTEXS constituent concentrations in the soil vapor have been monitored over time in conjunction with respiration measurements. The soil vapor analyses indicate a downward trend in BTEXS concentrations during the period between sparges. BTEXS concentrations are summarized in Table 1 below:

TABLE 1: Decrease in BTEXS Soil Vapor Concentrations After Sparging

<u>Time After Sparging (Days)</u>	<u>BTEXS Concentrations (PPMV)</u>
Same Day	400
5 Days	100
9 Days	20

Although there was no evidence of surface emissions during the sparge/biovent tests, a conservative approach for estimating BTEXS emissions would be to assume that the displaced soil vapor contains 10 PPMV of ethylbenzene (the approximate composition of the BTEX in soil vapor is 80 mole % ethylbenzene, 10 mole % toluene, and 10 mole % benzene) when it is released from the surface. An estimate based upon the total weekly volume of sparge air is as follows:

$$\frac{10 \text{ Ft.}^3 \text{ EB}}{10^6 \text{ Ft.}^3 \text{ SV}} \times \frac{2.44 \times 10^6 \text{ Ft.}^3 \text{ SV}}{\text{Week}} \times \frac{1 \text{ Lb. Mol EB}}{359 \text{ Ft.}^3 \text{ EB}} \times \frac{106 \text{ Lb. EB}}{\text{Lb. Mol EB}} = \frac{7.2 \text{ Lb. EB}}{\text{Week}}$$

This conservative calculation estimates that the total BTEXS emission from the sparge/biovent remediation at the four locations in the Central Plant Area would be 7.2 Lbs per week. Assuming 52 weekly sparges per year, the annual BTEXS emission would be 375 Lbs. (0.2 tpy).

Reference (1): Task 5 and 6 Report, Pilot Tests of Soil Vapor Extraction, Bioventing and Air Sparging at the Central Plant Area submitted to PADEP June 19, 1996.

**ESTIMATE OF VOLATILE ORGANIC COMPOUND EMISSIONS
ASSOCIATED WITH THE OPERATION OF THE
REMEDIAL SYSTEM IN THE OVER-THE-HILL AREA
AT THE FORMER LOCATION OF TANKS 4 AND 5**

1. Remediation Utilizing Air Sparging in Combination With Bioventing

A total of nine sparge wells will be utilized at the former location of Tanks 4 and 5 where sparging will be conducted in the Over-the-Hill (OTH) Area. The five wells surrounding the location of Tank 5 and four wells surrounding the location of Tank 4 will be sparged on alternate weeks on a bi-weekly cycle.

During 1994 air/helium gas tracer tests conducted at the former location of Tank 5 indicated that air would travel a distance of at least 50 feet in a radial direction from a sparge well (1). These tests also indicated that sparge air did not rise any further than 20 feet above the water table in the pore space of the vadose zone soils. At the former location of the two tanks, the water table is 31 feet below the ground surface and is situated in sand and gravel soils which are similar to those in the Central Plant Area. The low-permeability silty clay alluvial soils from Raccoon Creek have terminated east of where sparging will be conducted. However, some of these soils were apparently excavated and used to create a surficial silty clay layer as part of the earthen berm secondary containment which surrounds each tank. The silty clay surface layer is approximately 8 to 10 feet thick and exists throughout the area where sparging will be conducted. The silty clay layer blocked any vertical flow of sparge gas from entering surface collectors and monitoring wells which indicates little potential for fugitive emissions to emanate from the sand and gravel layer through the silty clay during sparge events.

Soil vapor monitoring wells located within a 60 foot radius of the sparge well, and screened up to 20 feet above the water table provided measurable respiration rates in terms of oxygen consumption and carbon dioxide production. These tests defined a "vadose zone bio-reactor" surrounding each sparge well. The reactor is shaped like a porous cylinder whose radius is 60 feet and height is 20 feet. The porosity of the sand and gravel soil near the water table at the sparge location is 30%. This gives a bio-reactor pore volume of 68,000 cubic feet.

The total volume of air introduced through a sparge well during a typical "sparge event" will be equal to the bio-reactor pore volume of 68,000 cubic feet (at standard conditions). This volume of air will be introduced at each well at a rate of approximately 400 SCFM in a 3 hour period every other week.

After sparging, a zone of aerated groundwater, soil and soil-vapor will have been created within an approximate 3,400 square foot circular area surrounding each sparge well. Aerobic biological reactions using indigenous microorganisms and the oxygen in the sparge air within this zone (i.e., the bio-reactor) should convert the BTEXS aromatic compounds in the soil and groundwater to carbon dioxide and water during the two week period between sparges. The two week long quiescent period was determined from respiration tests which

indicated that the oxygen contained in the sparge was consumed in approximately two weeks. The bioventing process described here is repeated after each sparge.

2. Emission Estimate

The total weekly volume of sparge air injected into the subsurface based upon five sparge wells is 340,000 SCF (5 X 68,000). As indicated in Section 1, the sparge air remains at least 10 feet below the ground surface during sparging. Subsequent weekly sparges will displace the air from previous sparges in a radial direction outward away from the sparge well. This displacement will ultimately lead to soil vapor being released from the subsurface at locations which are removed from the individual sparge wells. The soil vapor which is released will be a mixture of sparge air and air from the pore space of soil which is outside the radius of influence of the sparge wells. Because of the radial travel path of the sparge air, the soil vapor which is released at the surface will have resided in the subsurface for at least two weeks.

BTEXS constituent concentrations in the soil vapor have been monitored over time in conjunction with respiration measurements. The soil vapor analyses indicate a downward trend in BTEXS concentrations during the period between sparges. BTEXS concentrations are summarized in Table 1 below:

TABLE 1: Decrease in BTEXS Soil Vapor Concentrations After Sparging

<u>Time After Sparging (Days)</u>	<u>BTEXS Concentrations (PPMV)</u>
Same Day	400
5 Days	100
9 Days	20

Although there was no evidence of surface emissions during the sparge/biovent tests, a conservative approach for estimating BTEXS emissions from the sand and gravel layer after a sparge event would be to assume that the displaced soil vapor contains 20 PPMV of ethylbenzene (the approximate composition of the BTEXS in soil vapor is 80 mole % ethylbenzene, 10 mole % toluene, and 10 mole % benzene) when it is released from the surface. An estimate based upon the total weekly volume of sparge air is as follows:

$$\frac{20 \text{ Ft.}^3 \text{ EB}}{10^6 \text{ Ft.}^3 \text{ SV}} \times \frac{3.4 \times 10^5 \text{ Ft.}^3 \text{ SV}}{\text{Week}} \times \frac{1 \text{ Lb. Mol EB}}{359 \text{ Ft.}^3 \text{ EB}} \times \frac{106 \text{ Lb. EB}}{\text{Lb. Mol EB}} = \frac{2 \text{ Lb. EB}}{\text{Week}}$$

This conservative calculation estimates that the total BTEXS emission from the sparge/biovent remediation at the two tank locations in the OTH Area would be 2 Lbs per week. Assuming 52 alternating weekly sparges at each location, the annual BTEXS emission would be 104 Lbs (.05 tpy).

Reference (1): Task 6 Remediation Bioventing Field Test Report, submitted to PADEP January 27, 1995.

APPENDIX E-2
FUGITIVE EMISSIONS ESTIMATES

ESTIMATE OF FUGITIVE DUST EMISSIONS ASSOCIATED WITH REMEDIATION AT THE WEST LANDFILL AREA

1. Summary of Remedial Actions

The existing earthen cover on the West Landfill will be recontoured and upgraded. A more gradual-sloped terrace at the southern boundary will be created by cutting existing material back at the top of the terrace, and using material from on-site soil piles as fill at the base. The remainder of the West Landfill will be regraded with gradual slopes toward the perimeter. A layer of topsoil will then be placed over the ground surface and vegetated with grass.

2. Emission Estimate

An emission factor for fugitive dust from land clearing and cut and fill operations can be obtained from the U.S. Environmental Protection Agency publication AP-42, Compilation of Air Pollutant Emission Factors. Although there is no specific reference dealing exactly with the actions planned for the West Landfill, Chapter 11.2.4 dealing with heavy construction operations gives an approximate fugitive dust emission factor of:

1.2 tons per acre of construction per month of activity.

This emission factor is reportedly based on field measurements of suspended dust from apartment and shopping center construction projects. It applies to dust particles less than about 30 microns in diameter. AP-42 indicates that the quantity of dust emissions is proportional to the area of land being worked and the silt content of the soil (soil particles smaller than 75 microns in diameter). Dust emissions are inversely proportional to the moisture content of the soil, which can be increased by watering.

The earth moving activities planned at the West Landfill are not as extensive as those upon which the emission factor is based. Also, the soil being worked is mostly Ohio River alluvium which consists of coarse sands and gravels. A wash sieve analysis of the sand and gravel indicates that only about 10% of the soil particles are small enough to pass through a 75 micron sieve opening. More than 50% of the soil consists of particles which are larger than 2mm.

Based upon the anticipated type of activity, soil characteristics, and engineering judgment, an emission factor of 0.2 tons per acre per month was used to estimate fugitive dust emissions from the West Landfill. The area where the cover will be upgraded encompasses approximately 5 acres, and the duration of earth moving activities is anticipated to be one month. This gives a fugitive dust emission estimate of 1 ton for upgrading the landfill cover.